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BOULDER MOSAICS IN DAKOTA.

BY PROFESSOR J. E. TODD.

SUCH a name seems best to express the character of certain strange works noticed by the writer upon some of the conspicuous hills of Southeastern Dakota. The term mosaic, though describing better than any other word their structure, may suggest greater delicacy than they possess, but the qualifying epithet sufficiently corrects it.

A typical example, and the first to come to the writer's knowledge, was found on the summit of Keya Kakop, or Turtle point, three miles north of Wessington springs in Jerauld county. The point is a high promontory-like hill standing out on the western edge of the James River valley, above which it rises nearly 500 feet. It is the northern end of a high ridge of drift constituting a well washed interlobular portion of the principal moraine. A view of Turtle point and a portion of the ridge from the northwest is shown in Fig. 1. Upon the highest portion of the point is a low broad mound built of earth, perhaps fifty feet in diameter and three or four feet high. It does not differ materially from many that are found on the summit of bluffs along the James and Missouri. Its chief attraction is the gigantic figure of a turtle upon its southern slope, as is shown in Fig. 2. This figure is formed of boulders, four to six inches in diameter, quite closely and regularly set, so as to describe its outline. The head, legs and tail are extended. Its general appearance, position and structure are shown in Fig. 3. Visitors to the locality will also notice a rude human figure, sketched with similar material, on the south-west side of the mound as shown in Fig. 2, but it is confessedly the work of an early owner of the ground. To one not informed of the fact its recency would be apparent from the pebbles comprising it lying on the surface of the ground, while those forming the turtle are half imbedded. That it is not of the same origin as the turtle is further indicated by the representation of the legs and arms by *single* rows of stones. The locality was first visited by the writer in 1881, and the figures were intact when seen again in 1883. The figure is about fifteen feet in length from tip of tail to front of head. A little pile of stones lies a short distance in front of the head.

This work, interesting as it is, sinks into insignificance when compared with a similar work upon Paha Wakan, or Medicine hill, near Blunt, in Hughes county. This hill is also a high interlobular portion of the principal moraine, and presents the same general features as Turtle point, as will be seen in a sketch of it, from the east, in Fig. 6. It rises above the surrounding plain about 200 feet, and nearly 400 feet above the adjoining valley of Medicine creek. Its summit is flat and includes many acres. Granite and limestone boulders abound in profusion. Tipi-rings, *i. e.*, circles of boulders which were used in holding down the covering of the conical tents used by the Dakotas, are very abundant upon the summit. A few mounds of ordinary size are scattered in no apparent order. Near the north-western angle of the summit platform is the gigantic figure represented in Fig. 4. Its length measured roughly along its central line, following the crooks, is 120 paces. The general form, with length, breadth and number and shape of crooks, are as faithfully represented as a hasty sketch could give. The boulders composing it are from six to twelve inches in length, and are laid much less closely than in the turtle. The direction of its northern half is N. 18° W. The presence of the mound at its side seems to be accidental. The head is more carefully represented in Fig. 5, where an attempt is made to express the shape, size and position of the boulders composing it. The eyes are much more expressive than it would at first seems possible to make them with such material. They have literally a "*stony* stare." They are formed of two oblong boulders nearly a foot in length. The angular head and heavy body suggest the rattlesnake as the designer's model, but there is no clear representation of the rattles. Perhaps that was beyond the artist's inventive power. At *c*, in Fig. 4, the boulders have evidently been displaced, probably by water or frost action, as that portion is on an inclined surface. This gigantic serpent was in good condition when seen in 1883.

An examination of similar localities over all Southeastern Dakota has failed to discover any other similar representations of animals. Numerous rude sketches of animals on a smaller scale are found near Pipestone, Minn., chipped or pecked on the smooth surface of the red quartzite. Some of the best of these are exhibited in the Minnesota Geological Report, Vol. I. In these the turtle is a favorite figure, but none are as symmetrically represented as in the one on Turtle point. No serpent is represented among them.

Similarly made figures, but quite imperfect, were noticed by the writer on Wolf creek, south-west of Bridgewater, Dak.

But although no more animal figures have been found, a few other similarly constructed works have been noted. Upon Indian hill, north-west of Valley City, is a rectangular figure between two mounds which may be natural. The sides are remarkably straight and parallel, and the stones, which are four to twelve inches in diameter, are quite regularly laid. The ends are rounded a little. Its form is shown in Fig. 7. It is eighteen paces long and three paces wide. The direction of its sides is N. 78° E. A number of the stones composing it had been lately displaced in 1882 when the writer visited it. The holes in which they had lain were fresh and showed their form clearly.

Upon a high broad terrace of Crow creek, a few rods back and east from a remarkably fine spring which is at the foot of the terrace, and about a mile north-west of the town of Waterbury, is found a somewhat similar figure on a much larger scale; moreover it is incomplete and somewhat irregular. Its outline is shown in Fig. 8. It eastern side is ninety-two paces in length and is directed N. 2° E. The north end is curved slightly, but lies nearly at right angles with the left side, which is directed N. 15° E. At *a* is an opening which may represent a gateway, as an oblique line of stones, sufficient in length to close it, is at one end. Near it and at various other places are small circular pits, two to four feet across. No pains was taken to locate them accurately, as it was thought that they had no special connection with the lines of boulders.

The gap at *d* was probably caused by some recent removal ot the boulders for use in forming some tipi-rings not far away. At *b* is a circular pit with boulders on its sides and a pile of pebbles in its bottom. At *c* is a triangular pile of stones about three feet on each side. The southern ends of the sides are not far from the side of a ravine. A more careful examination would probably discover other interesting and perhaps more significant relations.

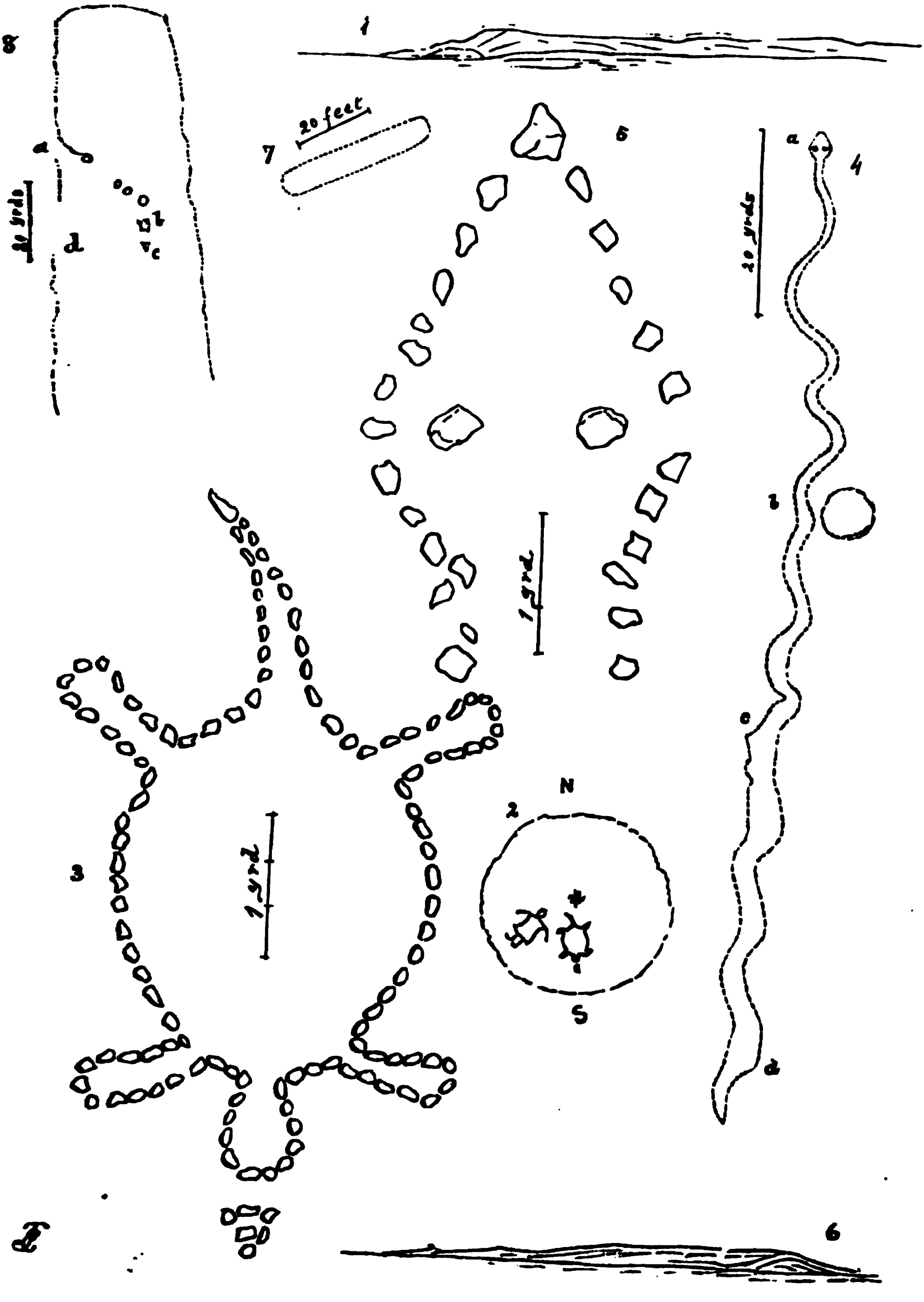
According to Mr. T. H. Null, of Waterbury, who has seen it, there is, on the S. W. ¼, S. 28, 109.66, a cross formed of two lines of boulders. One four rods long is crossed at right angles by another one and a half rods long. At the end of the first, which would correspond to the foot of the cross, is a pile of stones.

Though this completes the list of "boulder mosaics," it may not be out of place to speak of a somewhat related work noted by the writer, in 1881, in Brown county a few miles north-west of Westport. On the right bank of Elm river were two quite conspicuous mounds, 270 paces apart, upon two symmetrical knolls. Beginning at the top of the north-western one, a line of bones extended over the center of the other, and 146 paces beyond, where it ended in a small pile of boulders. The bones were mostly the leg bones of buffalo set up in the ground like stakes. That was before the land was in market. Ere this the plow of the white man has probably removed all trace of them. A few years more and the more enduring "boulder mosaics" will probably help to form the stone wall of some enterprising settler, as careless of the sacred associations attending them as the Turk who builds the fragments of ancient temples into his hovel.

EXPLANATION OF PLATE I.

FIG. 1.—A sketch of Turtle point from the north-west.
" 2.—Plan of mound with figures upon the summit of Turtle point, near Wessington Springs, Dak.
" 3—Enlarged view of the turtle in Fig. 2.
" 4.—Ground plan of the great serpent on the summit of Medicine hill, near Blunt, Dak.
" 5.—Enlarged view of the head of the same.
" 6.—View of Medicine hill from the east.
" 7.—Plan of a figure on the summit of Indian hill, near Valley City, Dak.
" 8.—Plan of a figure near Waterbury, Dak.

NOTE.—The figures are all drawn in their correct position with reference to the points of the compass.



Boulder Mosaics in Dakota.

A STUDY OF THE DANDELION.

BY E. LEWIS STURTEVANT, M.D.

THE dandelion is a plant of northern climates, especially found growing amidst the herbage of meadows, and as a weed in gardens. Its common name is a corruption of *dent de leon*, a word which is met with in the Welsh *Dant y Llew* of the 13th century. Its vernacular names in various languages have usually reference to the peculiar indentation of the leaves, or to some other resemblance or character of the plant. By commentators it has been identified with the *aphake* of Theophrastus, *a* in composition signifying absence of, and *phake* lentils, or the name perhaps signifying that the plant can be used as a green before lentils appear in the spring (?); the *ambubeia* of Pliny may suggest the scattering of the seed, *ambulo* meaning the going backward and forward, but some commentators assign this name to the wild endive or chicory; the *hedypnois* of Pliny is but doubtfully identified with our dandelion, and appears to be derived from two Greek words signifying sweet breath, and may refer to the sweet smell of the flowers. Pinæus, 1561, calls it *Dens Leonis, Dens Caninus, caput Monachi, Rostru porcinum* or *Ambubeia*, the *aphake* of Theophrastus; by the French, *Pissenlit* or *Dent de Lyon;* by the Germans, *Pfaffen roerlin.* Pena and Lobel, 1570, give additional names of *Urinaria*, German *Korlkraut* and *Phaffenblat*, Belgian *Pappen cruyt*, English *Dent de Lyon.* The modern vernacular names are: English *dandelion, swine's snout* (Prior); France *pissenlit, dent-de-lion* (Vilm.); German *lowenzahn* (Lenz); Flanders *molsalaad* (Vilm.); Danish *moelkebtte* (Vilm.); Italian *tarassaco* (Lenz), *dente de leone, virasole dei prati* (Vilm.); Spanish *diente de leon, Amargon* (Vilm.); Greek *agriomaroulia* (Sibth.), *pikraphake* (Fraas); Japanese *fosei* or usually *fudsina* or *tsugumi gusee* or *tampopo* (Pick.).

Bauhin, in his Pinax, edition of 1623, enumerates two varieties of dandelion, one the Dens Leonis latiore filio carried back in his synonomy to Brunselsius, 1539; the other, Dens Leonis angustiore folio, carried back in like manner to Cæsalpinus, 1583. The first kind, he says, has a large and a medium variety, the leaves sometimes pointed, sometimes obtuse. In the Flore Naturelle et Economique, Paris, 1803, the same varieties, apparently, are mentioned, one with narrow leaves and the other with large and rounded leaves. In Martyn's Millers Dictionary, 1807, the leaves of the dandelion are said to vary from pinnatifid or deeply runcinate in a very dry situation to nearly entire in a very moist one, generally smooth, but sometimes a little rough, and *Leontodon palustre* is described as scarcely more than a variety, as varying very much in its leaves which have few notches or are almost entire; the plant smoother, neater, more levigated and more glaucous than the common dandelion. In Geneva, N. Y., on the grounds of the New York Agricultural Experiment Station, a large number of varieties are to be commonly noted, both in the habit and appearance of the plant and irrespective of difference of soil or exposure, as varieties may readily be separated whose roots are intertwined. Some plants grow with quite erect leaves, others with their leaves closely adpressed to the soil; some have broad, others narrow leaves; some have runcinate leaves, others leaves much cut and almost fringed, and yet others the leaves nearly entire; some have almost sessile leaves, some have smooth leaves, others roughened leaves; some have thin, others thick leaves; some as varieties grow to a larger size, others are always dwarfer; some have an open manner of growth, others a close, etc.

The use of the wild plant as a vegetable seems to have been common from remote times, but its culture is modern. In 1836 a Mr. Corey, of Brookline, Mass., grew dandelions for the Boston market, the seed obtained from the largest of the wild plants (Mass. Hort. Soc. Trans., 1884, 128); in 1863 dandelions are described among garden esculents by Burr (Field and Gard. Veg. of America, 345), but the context not indicating any especial varieties; in 1828 Fessenden (New Am. Gardener) says the wild plant is used but never cultivated. In 1874 the seed appears for sale in seed catalogues (Briggs Bros. Cat., 1874), perhaps earlier, and the various seed catalogues of 1885 offer six names, one of which is the "common." In England, dandelion culture is not mentioned in Mawe's Gardiner, 1778, nor in Martyn's Millers Dictionary, 1807; the first notice I find is in the Gardeners' Chronicle, 1846 (p. 340), where an instance of cultivation is noted, the herbage forming "a beautiful and delicate blanched salad." In 1880 its culture had not become common, as this year its cultivation in France, and not in England, is noted (Jenkins Jour. R. A. S., XVI, 94). In France, Noisette, 1829 (Man. du Jard., 1829, 356) gives cultural directions, and says the wild plant furnishes a spring pot-herb; the plant is, however, not mentioned in L'Horticulteur Francais, 1824–5, nor in Nouveau Dictionnaire du Jardinage, 1826. Vilmorin (Bon Jardinier, 1882) states its culture in France as dating from 1868, and the firm of Vilmorin, Andrew et Cie in 1885 offer four sorts of seed, one, the "improved moss" as new. In Vilmorin's Les Plantes Potageres, 1883, two forms are figured, Pissenlit ameliore a cœur plein and Pissenlit ameliore tres hatif. The first of these is named in Album de Cliches, Pissenlit ameliore frise, and a fourth name or third form is figured, the Pissenlit mousse.

1. The type of the Pissenlit mousse can be readily found among the wild plants of the station grounds, very closely resembling Vilmorin's figure in every respect when growing on rich soil except that the leaf divisions are scarcely as much crowded.

2. The type of the Pissenlit ameliore a cœur plein is perhaps to be recognized in Anton Pinæus' figure, 1561, and is certainly to be found growing wild at the station.

3. The Pissenlit ameliore tres hatif is figured in 1616, the resemblance between the two figures, the one by Dodonæus and the other by Vilmorin, is very close. It is also to be found growing wild on the station grounds.

The influence of rich soil and protected growth upon the dandelion is to give increased size and succulency to the plant, and to thicken the branching of the leaves, in the direction of answering the description of *a cœur plein;* but this influence appears to be limited by the heredity of the plant, as the types do not react to an equal extent. This fullness or hearting in No. 2 seems to come from the strong tendency in plants of this type to divide the root into a group of crowns; the leaves, also, in rich soil, grow rather upright with the upper portion curving outwards, giving a curled appearance to the plant, and thus justifying Vilmorin's alternate name "frise." The No. 3 form is more succuent in rich soil than the others, attains size distinctly earlier, is less crowded and less upright in growth, and in some cases is very closely adpressed to the ground. No. 1 type does not in all cases seem to be a depauperate form, as it is found on fertile soil along with the rest, it is usually small, but in some instances is of fair size and quite bunchy growth. A form with nearly entire leaves has not yet reached culture under a distinct name; this type is distinctly smaller than the rest, and some plants have sessile and thickened leaves, other plants long petioled and spatulate-like thin leaves. In all the forms some plants may be looked for with hairy and roughened leaves.

In view of the limited extent of the present culture of the dandelion, and the short time since its cultivation was first attempted, as well as to the fact that its present culture about Geneva seems unknown, it seems unreasonable to infer that our plants are escapes from cultivation, and much more so when it is considered that these same described types are common elsewhere in Western New York. If not escapes from cultivation the inference seems strongly established that our cultivated varieties did not originate under cultivation, but are simply selections from wild types. If this be granted it may be legitimately questioned whether other of our cultivated form-species in other plants are not likewise of natural origin.

A careful investigation into the history of the origin of our cultivated varieties fully justifies the statement that I have as yet secured no data which justifies the belief that form-species in culture are other than of natural origin, and I have secured much evidence in favor of the view that form-species are introductions from natural variations. Before, however, such a radical belief can receive countenance, much must be done in the herbarium study of varieties as collected from various sources, in order that we may have wild forms to which our cultivated types can be referred. Our so-called modern vegetables, introduced as novelties, often seem to be such only because we are unfamiliar with what our predecessors possessed. Thus the figure that Pinaeus gives, in 1561, of a lettuce answers to our stone tennis-ball variety as closely as do the figures in our seed catalogues to the varieties whose name they carry; the deer-tongue lettuce introduced as a novelty in 1883 seems nearly identical with the Lactuca folio oblongo acuto of Bauhin's Prodromus, 1671; a large number of our capsicums or peppers seem to be identical with the varieties figured in Hortus Eystettensis, 1623; new types of squash followed the appearance of the Valparaiso from Chili in the early part of the present century, etc., etc.

Under the hypothesis that the form-species of cultivation are originally from nature, we can explain the permanency of these form-species, and their resistance to change from cross fertilization, the tendency seeming strongly towards trueness to type, and the purging themselves from contaminations unless restrained perhaps by human selection. Thus two form-species of maize, when crossed, have not produced intermediates in their crop, but the parent types without intermediates, and the continuous planting of the progeny tended toward a complete separation into the original types. Various crossings of a like kind, made at the Experiment station, seem confirmatory of this view, and seem to suggest in addition that seeming sports are often the result of atavism.

Appended are a few of the variations which are to be found in the leaves of the dandelion, selected rather as representative than as exceptional. A series could readily have been selected showing a passage from one type to another, as frequently leaves of quite different appearance appear on the same plant.

Varieties o! Dandelion leaves.

THE RELATIONS OF MIND AND MATTER.

BY CHARLES MORRIS.

(Continued from p. 1159, December number.)

MUCH space might here be given to the numerous and important observations on hypnotic phenomena published of late years, but we must confine ourselves to the mesmeric experiments of the Psychic Society. These experiments were very numerous, and were conducted with such extreme care that their evidence in favor of direct mental communication seems incontestable. Their results were of a more declared character than those of the thought transfer experiments. Not only thought transfer but mind control appeared. The active seemed to take full possession of the passive mind, and this often with a considerable distance intervening between the parties. The thoughts of the one mind appeared to infuse themselves into the other, driving back its own consciousness and replacing it with a pseudo-consciousness, and this so completely that the sensations of pain, taste, &c., felt by the operator, were also felt by the sensitive, and referred by him to their appropriate locality in his own body. In like manner the direct control of the mind of the sensitive over his body and of his body over his mind was exercised by the operator, and consciousness of pain in any part could be abolished at will. Some of these phenomena, indeed, were so curious and the mode of producing them so significant, that it certainly appeared as if the whole body was permeated by psychic substance, and that the mind was related to the outer world by psychic nerves in an equivalent sense to its material nerve connection.

In these mesmeric phenomena, however, it is evident that the channel of communication between mind and mind is not usually an open one, or the body psychically transparent. Most persons are more or less obtuse to the psychic sense, and only in special cases is it freely active. And in these cases the relations of operator and sensitive are personal. No second operator can exert an equal control over the sensitive. It is as if the psychic nerve, like the physical nerve, became susceptible to familiar influences, but resistant to unfamiliar ones.

Of the other phenomena adduced by this society it will suffice to refer to those of psychic communication at a distance, of which they give many seemingly well authenticated instances. In one of these the thought transfer passed as far as from Burmah to England. In these latter instances there was, in nearly every case, an active mental excitation in the one mind in reference to the other. They are most usual at the moment of death, the mind of the dying person appearing to be affected with a strong emotional longing to communicate with the living. In many such cases a spectral reproduction of the dying person has appeared to the subject of his or her thoughts, apparently in real form, but doubtless as an image impressed directly on the mind. It may be that a sudden rousing of the recollection of any distant person, without its being led up to by a train of conscious thought, might, if the effect be a strong one, seem like an actual vision. An object seen is not led to by consciousness, and a mental image not led to by consciousness might easily have the force of an object seen, or of a temporary hallucination. In many of the numerous instances given, the person whose image was seen was in full life, yet in some perilous situation or other condition that would be likely to arouse sudden and intense emotion. And usually the recipient was the object of this emotion. There is no evidence to show that this relation did not exist in every instance, but simply that it was not always observed.

As to the distances to which these impressions were frequently conveyed, or the rapidity with which they passed from mind to mind, there is nothing surprising if the hypothesis we have given be accepted. We know the rapidity with which light travels through the ether, and the electric current through solid matter, affecting objects very far removed in very minute intervals of time. We know that the influence of gravitation is felt with no apparent lapse of time through vast distances. The least variation in distance and weight of one body is instantly felt by other bodies, though they may be very distant. If there be a psychic substance it is highly probable that the same relations may exist between its separate masses. The ether may convey its vibrations to vast distances, as it does those of matter, and produce similar effects on distant psychic masses. If this substance is transparent to the vibrations produced by matter, matter may be similarly transparent to its vibrations and no check to their outflow be felt. We know that an electric charge, when sent "to earth," spreads with immense rapidity throughout the substance of the earth. It weakens as it spreads, yet may be strong enough at a considerable distance to act upon a sensitive electric instrument. The matter of the earth may be still more transparent to psychic radiations, and permit them to spread with the utmost freedom and rapidity. Such impulses might touch without effect a multitude of minds, and yet rouse one mind to consciousness if it met there with conditions in harmony with the conditions of the vibration. A thought is an active and peculiar motor energy. It carries with it, when emitted, the characteristics of its source. If it meets anywhere a psychic condition to which these characteristics are familiar, or with which they are harmonized, it might rouse a conscious response, or call up, more or less completely, the mental image of the emitting mind and person.

There are other phenomena which seem to indicate the existence of such a medium of psychic communication. And the indications are that emotion is necessary as a preliminary to distant and vigorous outflow of psychic energy, though not necessarily so in case of contiguity. In emotion the motor conditions of the mind seem strongly exercised, as are those of matter in case of high temperature, and in both cases there seems an energetic outflow of vibrations. It is well known that a congregation in a state of emotional excitement can be swayed by an emotional speaker in a manner that utterly ignores all exercise of reason or individual intellect. The power of all great orators over an audience has been largely of this emotional character, and audiences are frequently fully controlled by addresses which, read in a cool state, arouse surprise how they could have affected any person of sense. An instance of the same character is that of the sudden panic which has so often spread like wild fire through a whole army, sweeping away regiments that have not felt a bullet of the enemy. The intense mental excitement seems to flow out in vibratory waves, affecting all minds within its influence, and arousing everywhere a similar excitement without regard to difference of circumstances.

History is full of instances of the same general character. And we find in every instance that it is the ignorant, or the strongly emotional, who are swayed by these influences, while the educated, the cool and the reasoning minds resist them. Several instances from the history of middle age Europe may be adduced. We might describe the epidemics of migration, as in some of the Crusades, of witch-craft, sorcery, lycanthrophy, etc., that have from time to time broken out, and raged in spite of every effort at suppression. But we have only space for some of the more particular instances. It is significant that the most remarkable of these emotional epidemics have followed terrible pestilences, famines, or other great national calamities. Thus the terrible "Black Death" pestilence of the fourteenth century, which threw all Europe into a condition of severe mental depression, and roused a host of superstitious fears, was followed by extraordinary outbreaks of fanaticism. These were the Flagellation mania and the Dancing epidemic. In the one, Europe was filled with throngs of self-flogging maniacs. In the other hosts of dancing and singing convulsionists everywhere appeared, seemingly possessed by a fury, and convulsively leaping until they sank down in utter exhaustion. The Tarantula epidemic of Italy was of the same general character.

Two cases related by Zimmerman may be here particularly given. In one case a nun, in a very large French convent, began to mew like a cat. Soon others of the nuns imitated her, and ere long the whole of the sisterhood were diligently mewing. So strongly did the mania possess them, that it was only broken up by the stationing of a company of soldiers near the convent, with a threat to whip any one who should indulge in the peculiar vocal exercise. Dread of the whip proved a stronger mental force than the desire to mew, and the convent returned to its former peace and quiet. In the other instance a nun in a German convent, of the fifteenth century, began to bite her companions. Soon all the nuns fell to biting one another. As the news of this spread to other convents the biting mania broke out there also, until it spread throughout Germany and Holland, and extended so far as Rome.

The emotional character of the mental operations of a religious sisterhood probably renders them specially susceptible to such psychic influences. In all such cases a considerable degree of mental excitement seems to have attended the mania. And it has been usually confined to the lower classes, though in a case of long continuance, like that of the Flagellants, nobles and ecclesiastics, with many other persons of honorable birth, became affected. In these days of science, education, and active thought generally, such extended manias have ceased to exist, though minor examples may yet be found in ignorant communities. In all these instances there seems to be a general outflow of psychic energy of a peculiar kind, which acts to produce accordant states in all minds into which it flows, unless they are intellectually active enough to resist its influence. We all know how difficult it is, even in educated persons, to resist the psychic influence of a strongly emotional speaker, even though the reason may resist his arguments, and how resistance becomes lulled and conviction produced, by the pure force of "personal magnetism." And knowing this we cannot wonder at the remarkable influence of some very irrational revivalists.

The subject has here been very briefly and incompletely treated. Had we space to give in full the abundant evidence that might be offered, and to detail the strict test conditions under which it was often received, the fact of a direct intercourse of mind with mind, and control of one mind by another, without the intermedium of the senses, might be shown far more clearly. And the indications strongly point to some such conclusion as that here reached, that the mental powers are based in a special psychic substance, and that masses of this substance act upon each other through the ether in methods closely similar to those in which masses of matter act on each other.

One further question of great importance here comes into play. If psychic substance begins its existence as "bound ether," ether condensed by the attractive force of atoms and molecules, can it exist in this condensed form separate from the atoms and molecules? If these continue to exist must their ethereal atmospheres remain permanently bound to them? If they should in any way be destroyed, would the ethereal atmospheres resume their original condition of free ether? If we have dealt with pure hypothesis so far, it may be well to follow our hypothesis to its ultimate consequence.

That bound ether is an existing fact is becoming more and more generally admitted. Sir William Thomson, in a recent paper,[1] views it as a necessary condition to the phenomena of refraction. And if it exists it seems equally necessary that the ethereal atmosphere must be affected by the motions of its nucleus and assume accordant motions. If so, the destruction of the material nucleus might leave the condensed ether as a persistent atom or molecule, since it would possess the motor organ-

[1] Read before the Royal Society of Edinburgh, January, 1885.

ization of a material atom or molecule. On the other hand, while the atom or molecule of matter continues intact, it would seem as if its bound ether must remain confined to it and accompany it through all its integrations and disintegrations. Absolute accordance in motions and the persistent vigor of attraction must prevent any separation of the bound ether from its nucleus. Under these conditions, therefore, there could be no separate existence of a psychic substance.

But this is but one of the probable conditions of existence of this substance. Bound ether may be strongly influenced by other motor energies, which but feebly influence its material nucleus. In this respect the phenomena of the mind lead to some very interesting conclusions. If the physical basis of the mind be the bound ether of the cerebral cells and molecules, it must originally be intimately related in motion and condition to these cells and molecules, and can have no power of separate existence. But the whole process of development of the mind is one that tends to break up this intimate connection. The psychic substance of the cerebrum is affected, not only by the normal cerebral motions, but by innumerable motor conditions coming from external substances, through the medium of the nervous system. These conditions but slightly and temporarily, so far as we can judge, affect the sluggish matter of the cerebrum, but strongly and permanently the mobile substance of the mind. The mental substratum thus becomes affected by motor conditions which have no fixed counterpart in the brain substance. The original close motor accordance is broken; and with it the effect of molecular attraction is weakened. Such a result would be precisely parallel to that common in chemical action, in which motor inharmony seems a steady opponent of the force of affinity. Affinity is most vigorous when motor harmony exists. If the motor inharmony becomes great, molecular separation takes place. A similar rule may well hold good between the cerebral molecules and their bound ether. As the absorption of external energies by the bound ether produces motor inharmony, the effect of the attraction is steadily weakened. The bound ether is converted into specially organized psychic substance. In such a case there might be a fresh condensation of ether around the molecules, and this, in its turn, would become the recipient of new inflowing energies. In this way a continually increasing volume of psychic substance might be formed by the addition of new surface films, each becoming specially organized by sensory influences, and losing its intimate relation to cerebral matter.

In such a method the bound ether of material molecules may be converted into the psychic substance of mind. And with every transfer of energy from matter to psychic substance, consciousness may declare itself. The conditions of mental development and mental reception of sensations, as considered in the preceding section, are in close accordance with this idea. We have not matter with two sides, or with duplicate physical and mental motor relations, as considered by Mr. Bain in his Mind and Body, but two distinct conditions of substance, originally intimately bound together, but becoming separate as their motor conditions become inharmonious. In such a case the disintegration of the brain would not carry with it the disintegration of the mental substratum. The latter has ceased to be the bound ether of the former, and the cerebral molecules could only carry with them their latest increment of bound ether without affecting that which had escaped from this condition. Nor could the energies which cause the disintegration of the brain produce the same effect upon the psychic substance. A substance through which the most vigorous motor energies, such as those of light and heat, pass without producing any permanent disturbance of its conditions, might remain utterly unaffected by the most intense disrupting energy of material agencies, and survive the body as a concrete organism.

In fact the close connection between brain and mind seems to depend in some measure upon the activity of the brain. This activity appears to enhance the attractive hold of the cerebral cells upon their psychic outgrowth. It is during the stage of cerebral activity that external sensations are most abundantly and intensely received. With the partial cessation of this activity which takes place during sleep, some degree of weakening of the bonds between mind and body seems to take place. During deep sickness, or at the near approach of death, the bond seems to become still weaker, and the mind, with no impairment of its activity, seems often to be partially independent of the inactive body. The complete cessation of cerebral activity, which comes with death, may utterly break the bond of connection, the molecules of the brain only retaining their latest increment of bound ether, while the organized psychic cerebrum becomes a free organism. Whether with it is freed a closely related psychic organism, the outcome of the whole body development, and reproducing every detail of the body, is a question of secondary concern. It is sufficient for our present purpose to show the conceivable separate existence of a psychic cerebrum, possessing the definite organization of the material cerebrum, and in addition all the thought conditions of the developed mind.

If the human body, as the highest outcome of its organization of energy in matter, is capable of producing such a self-centered and self-existent psychic organism, a like power, though in a lower degree, must exist in lower organic beings, and possibly in inorganic compounds. Every concrete mass which received external energies, without being molded by them, might have its bound ether molded by these energies and thus converted into psychic substance, capable of self existence when definitely separated from its nucleus. All matter may thus act as a laboratory for the elimination of psychic substance from bound ether. The freed mental organism might find an accordant sphere of existence thus prepared for it, and as thoroughly adapted to its powers and needs as the material earth is to ours. Nor could we become sensible of the existence of substance in this condition, its complete transparency to radiations of light and heat rendering it imperceptible to our senses and our instruments. Such may be offered as a speculative conception of the possibility of the existence of the mind after the dissolution of the body, in a sphere of substance suitable to its needs and powers. It is a conception towards which many partial steps have been made, but this may be offered as the first definite hypothesis of the development and conditions of the mind, based upon the conclusions of modern science.

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SOME NOTES ON THE LIFE-HISTORY OF THE COMMON NEWT.

BY COL. NICOLAS PIKE.

THIS little reptile, our common newt or spotted eft, *Diemyctylus miniatus viridescens* (Raf.) Cope, is numerous on Long Island from Brooklyn to Greenport, and is equally well known all over the Eastern States. It may be caught from March to December, as it bears a very low temperature, and I once saw it swimming under the ice in a pond near Fort Hamilton. It is gregarious, bears confinement well, and I have often kept it for over a year in my aquarium.

Its food is very varied; it will take aquatic and other insects, small tadpoles, worms, especially earthworms, and it will eat small pieces of raw beef and fish when hungry. Though a harmless little reptile, it will quarrel occasionally with its companions about food. I have seen one seize a worm twice its own length and try to gulp it down holding it with the hands; a second would snatch up the other end and begin swallowing it till the two met. Then such a pulling and wriggling ensued, till the strongest or most persistent succeeded in making the other disgorge its meal. Sometimes it would take nearly a day before the worm vanished, the first part having to be digested before the last could be swallowed. In confinement they should have only the smallest worms, as the large ones disagree with them, and I have often had them die after one of these gorging meals. They are very fond of the small fresh-water bivalves so abundant in most of the ponds they frequent. Many are swallowed whole; one I dissected had four —shells and all—in its stomach.

When caught the little harmless creatures do not try to escape but hang limp in the fingers.[1] They are, however, as cunning as all the rest of their race. I placed one on my table to examine it, when it crawled under a sheet of paper and crouched down as if asleep. I was called away for a few minutes, and on my return found my little friend had absconded. Now it had not attempted to move for over an hour in my presence, but was evidently at once conscious of my absence. It was sometime before I found it on the opposite side of the room, it was so nearly the color of the carpet. It never does to trust to the apparent helplessness of any animal, for what it lacks in outward means of defense it is sure to make up in cunning.

I accidentally found out one of this animal's most deadly enemies. I once brought home a lot of the *viridescens* in a box of leaves in which I had thrown some wire-worms, thinking they might serve as food, they were so abundant around the pond. The next morning I found my poor little prisoners had all been

[1] Sometimes they emit a faint cry, but this is generally in the breeding season. It is a faint squealing sound not unlike that made by the *Spelerpes ruber*, but not so loud, and is I believe only heard from the males.

attacked by the wire-worms, pieces of flesh being eaten out of their living bodies. One had coiled so tightly round its victim it was paralyzed and died directly I removed it. Though so abundant, yet large numbers when young are devoured by the strong larvæ of the *Amblystoma punctatum;* the robust frog tadpoles also mercilessly nip off their gills and tails, and they soon die. These facts I have often witnessed in my aquarium.

Everyone knows these pretty olive-backed newts, yellow underneath, the whole body and tail spotted black, and on the sides a row of flame-colored spots encircled black, but everyone does not know, and perhaps never saw the change that takes place on the approach of spring, when the males assume their brightest dress preparatory to courtship. Over the back and tail waves a graceful spotted crest, the color underneath changes to orange, and the inner side of the legs is deeply barred jet black—all of which last during the breeding season and then the crest is absorbed, the black bars and bright color fade out till the next love time of the year calls them forth.

I believe this animal is incapable of reproduction under four years of age, for its growth is very slow even in its natural state. When the love-making commences there is a busy time amongst the denizens of the ponds. The males dart about, gyrating round their chosen mates, heading them off in their endeavors to escape, and when they have at last won the victory they seize the females round the lumbar region and remain thus often for hours. The milt and ova pass simultaneously, and the operation takes some time, but it is generally accomplished under cover of darkness. The older females often deposit 150 to 300 eggs at a time, which they attach to twigs in the water or long grass. The eggs are very small at first but rapidly swell. Younger females only lay from twenty to fifty eggs in a small group.

I am not aware of any one having published any account of the hatching of the eggs of *D. viridescens* except Professor A. E. Verrill, who, in the AMER. NATURALIST for 1870, wrote as follows: "The eggs of the common water newt were observed by Mr. S. J. Smith and myself at Norway, Maine, in '63 and '64, attached in round masses, two or three inches in diameter, resembling frogs' eggs, on stems of water plants in ditches in a meadow. The eggs were found May 5th, and reared by Mr. Smith, hatched May 17th, and by October 1st were one and a half inches long. They had stout bodies and broad heads, and still retained their external gills, though they had partially acquired the colors of the adult. The experiment was then discontinued but the specimens all preserved."

This only came under my notice in October, '84, when I was delighted to find Professor Verrill's statement verified my own experience, which I will now relate:

On the 6th April, '84, a quiet cool morning, whilst sweeping my net in a pond at Jamaica ridge, I detached some bunches of ova from several dead branches that lay in the water. They varied in size from two and a half to six inches in diameter, containing from 25 to 150 eggs each, all enclosed in a glairy mass. The eggs were brown above, pale beneath, each in a greenish double envelope, but so transparent that the development was distinctly visible.

This is a most perfect arrangement for the protection of the ova; a space lies between the envelopes and each can be separated in its own globe of glaire from the rest. These coverings are tough and not easily injured, and so firmly attached to the branch I had difficulty in loosening the whole without breaking it up. It would take a very strong wind or current to dislodge these carefully protected embryos.

They were all deposited on the south side of the pond where the sun shone in between the trees, about six or eight inches below the surface, in very clear water. I brought them home in a pail of water and placed them in an aquarium. I prepared for them with aquatic plants and débris from the pond. I thought I had secured the spawn of the *A. punctatum*, not thinking of Diemyctylus, which is mostly accredited with depositing one or two eggs separately in a folded leaf. From the appearance of the ova some must have been laid the preceding night, while others showed a curious mass of small granulations.

In a few days a sort of break up of some of the ova took place, if I may so express it. The embryo assumed a fish-like appearance with a blunt head, curled up tail and a thick solid body. During the next fourteen days the brown body enlarged, head was very dark, outline of eyes visible, snout broad and thick and if shaken the little creature displayed considerable irritation by a twitching of the tail. By the 20th the body was elongated and curved, the flattened tail showing a fin, the vertebral striæ and branchiæ with the minute claspers all were visible with a good glass. The glairy coverings enlarged with the creature's needs, and by the 28th some had emerged and commenced life on their own account. On the 9th May the film disappeared from the eyes, the gills were free, and what seemed to be thin white threads were really the first appearance of the anterior legs, but only by the aid of a powerful glass could the two little claw-like fingers be seen. A dark stripe showed from nostril to eyes and another on the head, and the whole body was covered with fine dottings.

It is very difficult to know what is the food of these mites, at this stage only half an inch long. It can only be the minute monads and confervacious spores in the water. The glairy envelopes remained long without decomposition, intact but for the cleft by which its occupant emerged. I am half inclined to think the young still feed on them, for they hang round them constantly; I know frog and toad tadpoles will feed greedily on these empty shells.

The little newts would remain motionless for a long time as if dead, but if disturbed would rush madly round. The whole of the ova did not hatch till the middle of May, so the first out must have been laid in March. By the 15th there was little doubt in my mind that I had at last solved the problem of the spawning of the Diemyctylus. The reddish gills were well fringed, the eyes prominent, the front legs transparent and white fingers free, the abdomen shewing the viscera, and the body dotted all over. A dark stripe from snout to eyes is, I find, never absent in the larva of this species.

On the 25th I procured a quantity of Lemna or duckweed for my aquarium, and it spread all over the surface of the water. My little pets delighted in it, and when the sun shone they would crowd under it in every position, seeming to hang on to the slender roots.[1] They certainly throve in their leafy home, and flourished so well that in a month, on the 25th of June, they were an inch long, very active, brownish-gray in color, with a series of whitish markings where the spots were to appear later. The abdomen alone was spotless. Two fingers and two knobs showed in front, and the hind legs were out but the feet only slightly

[1] Possibly the Lemna contained minute spores, or ova of insects, which served them as fresh food.

developed. The young begin to molt in confinement about the second month; later on, with every change, the spots which are only blurred white markings at first, assume a more definite shape. The adults change their skin frequently when they have abundant food, which has the same effect on the Urodela as on the ophidians.

Thus far all went well, but then began the great trouble always experienced at this stage in rearing the Urodela, much greater than that of the Anura. The latter will feed greedily on decomposed animal matter that the former seem to care little for, in confinement at least. I tried every kind of aquatic plant and small insect I could get from the ponds, but uselessly, many died and the rest were thin as shadows but active as ever. A few survived till August and well proved their identity, when I put the last but one in *spirits to save its life!* The last I kept alive till nearly the end of the month by feeding it on little red mites that swarm in the ponds at that season, but even it succumbed, and it was still only one inch long when it followed its mates, never having grown since June. I preserved a series of specimens from the spawn upwards, and I hunted the ponds so persistently that I was able to supplement my own deficiencies by larvæ from them in every stage, so that now it is complete in my cabinet from spawn to a fine adult five inches long.

To show the difference in rearing these animals in confinement and in their natural state, I will mention that on June 14th I took some larvæ from the same pond over two inches in length and quite fat. Doubtless the great increase of size over mine was due to abundance of suitable food, fresh air and abundant room to swim about in. I have had ample proof that the breeding season extends even to May, from the very small larvæ I have taken even in July.

Some young taken in September were a dark olive, the tail nearly black and feet dark; those of October showed a little dotting on the chin; those of November had the gills absorbed, were about two and a half inches long, and were sparsely dotted underneath, but the side spots still white. I do not think the flame color always comes in till the second year, and the buff color of the abdomen shews about the same time. As the animal nears the period when the gills completely disappear, its body diminishes in size, and I have taken some in the second year on land barely two inches, tail included. The atrophy of the branchiæ begins at the extremities and goes on very gradually till the fimbriæ are absorbed, when the rest roll up and leave two rounded tubercles that I have still found in specimens taken in December just before hibernation.[1] As the gills are absorbed the form of the head changes. During their growth it widens considerably in front of them, but on absorption the neck becomes narrow, and between the eyes it is broader. The fin, round back and tail vanishes at the same time.

Both sexes leave the water after the mating is over for a time, and hide, without feeding, under stones and tussocks. The young of the second year sometimes leave the water for months together and secrete themselves in damp places. When droughts occur and the ponds dry up I have often dug them out, all huddled together, more than a foot below the surface, and where the clayey ground has become so parched that they are unable to burrow they are often seen several together, dead and dried up.

This season, 1884, an exceptionally mild one, I took, on a bright warm day early in December, quite a number of large *viridescens*, both male and female, very active although there was a thin coating of ice on the pond. The former had the legs already barred and the tails finned, while the latter were large and fat. I dissected a female and found her full of good-sized ova.

Diemyctylus mineatus (Raf.) Cope (Eastern water newt).—This little animal, formerly supposed to be distinct from the last described, and mentioned in the latest bulletin of the Smithsonian Institution, is now generally acknowledged to be only a color variety of the *D. viridescens*. Dr. Hallowell was the first to express his belief that the so-called distinct species were the same. Professor Cope[2] says, "the nominal *D. miniatus* is a state of *D. viridescens*," and that he has had it change to the latter in confinement.

Mr. Howard A. Kelly, in an article in the AM. NATURALIST, states, "he brought home a number of *D. miniatus* (Raf.) or little red lizard or red eft, and after keeping them in a dark box filled

[1] These animals do not, I believe, really hibernate in the usual acceptation of the term, that is, they do not often become dormant. In January and February, when the ponds are frozen over, they resort to the deep holes, where they remain huddled together, if not disturbed, till the genial sunshine again calls them forth to activity.

[2] Professor Cope has studied the Urodela perhaps as much and as carefully as any one in this country, and is therefore an undoubted authority on the subject.

with saturated moss, they changed their color from a bright vermilion to the olive state characteristic of the *D. viridescens*," and he kept them all winter.

I have gradually come to the conclusion that the two are identical. Some years ago I captured quite a number of red ones in the Catskill mountains, brought them home and kept them in a box with other salamanders, where they could resort to water if they chose. For some days they remained hiding under the wet moss and stones, but finally crept out at night and went into the water. I gave them insects and worms, which they readily devoured. In about three months they lost their bright red, and in less than a year they were of the usual olive of the *viridescens*.

Another fact still more decidedly bearing on the case, is, that some two year old olive-colored *viridescens* taken from the ponds and put in earth and dead, wet leaves in a tub in my garden without water, in a month or so began to lose their green tint and assume a dingy brownish hue.

It is well known that the Diemyctylus often stays away from water for months at a time, but roams round at night in the damp earth and grass in wet weather.

The food these animals take plays also a very important part in their coloration and growth, just as we see in the whole animal kingdom. In the ponds the *viridescens* is generally a dull olive, almost the color of the green slime and plants covering them, in which they hide almost unseen. On land, where they are always in the day time, either under stones or dead wood or in the earth they have burrowed in, they assume more the color of these objects to hide from whatever enemies they may have in their new habitat.

Then as to food; in the water they have abundance of succulent nutriment — mollusks, tadpoles, ova of reptiles and fish, aquatic insects and plenty of confervaceous plants on which they and their prey alike feed, and which doubtless assists in their coloration. Now as soon as they leave the water their food changes at once to spiders, insects, earthworms, &c., so totally different from the prey of the ponds, and it is most probable this is the first cause in the change of color in the little Diemyctylus.

Locality has also considerable to do with the tints of the skin in these animals, as we see so prominently in snakes, especially in the genus Eutænia, where difference of locality has had such an effect on the coloration as to give rise to several species being made out of the common garter snake.

I have procured these newts from many places in New York and New Jersey States and different parts of Long Island, of every shade of red-up to very bright scarlet, yet within a radius of many miles from Brooklyn, where the *viridescens* and its variety are both plentiful, I never find the latter other than a reddish-brown, varying from light to very dark. Sometimes late in December I find little brown ones with flame-colored spots, in the ponds. These are so greatly attenuated it is possible they have returned to the water in search of food, lacking on land, at so late a period when all animal life which would be available for them disappears from the surface.

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THE RELATION OF THE PECTORAL MUSCLES OF BIRDS TO THE POWER OF FLIGHT.

BY CHARLES L. EDWARDS.

OF all the modes of animal locomotion flight is the most rapid, the most graceful, the most fascinating. With one important exception this power separates the bird from the other vertebrates and gives it preëminence in motion. Its whole structure—the conical form of the body offering so little resistance to the air, the hollow bones, the air-sacs and the weaving together of the smallest barbules to form the close web of the wing—all denote that in the air, in flight, is the bird's life.

While in a very general way much has been observed with regard to the variation in the power of flight of species differing quite widely from each other, yet there are still some unsolved problems connected with the highest form of motion.

Before attempting the solution of any special problem there are certain mechanical elements of flight with which we must become familiar.

A body much heavier than air is to be propelled with great speed through the air. The resistances are the force of gravity and the air itself.

The perpendicular action of the broadly expanded wings opposes as much as possible the force of gravity, while the narrow wing-line and the cleaving form of the conical body reduce as much as possible the resistance of the air in front.

The cause of motion is the action of the wings upon the highly elastic air producing by reaction forward movement of the body. The source of this action is in the pectoral muscles. Its instruments are the wings. Wonderfully indeed are the wings adapted to their purpose. Of extreme lightness and of great rigidity and strength, their weight is but a slight hindrance and their leverage a vast advantage in producing motion.

Concave beneath and convex above, with underlapping feathers, to the one side is presented a grasping surface almost impervious to air, and to the other a lattice-work structure through which air easily rushes. So in the depression of the wing all possible advantage is gained from the elastic resistance of the air, and in its elevation the least amount of force is lost.

The muscles which furnish the propelling force to the wings are those of the breast, the pectoralis major and the pectoralis minor. The pectoralis major is a large, triangular muscle forming the principal part of the bulk of the breast. It arises from the ribs, from the outer portion of the ventral surface of the sternum, from the side of the keel of the sternum, from the furculum and the membrane connecting the furculum with the sternum and the coracoid. The fibers converge, the outer turning under the inner and inserted by a tendon on the greater tuberosity of the humerus. In action this muscle depresses the wing and thus furnishes the great motive power of flight.

The pectoralis minor is much smaller than the preceding, and beneath it; arising from the middle portion of the sternum and the membrane attaching the furculum to the sternum and the coracoid. Its fibers converging terminate in a tendon which, after passing through the end of the coracoid, is inserted on the inner side of the greater tuberosity of the humerus. This muscle, together with the resisting force of the air, elevates the wing after it has been depressed.

From the structure of the wing it is apparent that the work of this muscle is relatively small except, perhaps, in "sailing," as seen in the flight of swallows, where the wings must be held tense and at a constant angle by this muscle. It would clearly appear, when we consider the law of muscular development, that in those species which fly most of these muscles would be relatively larger than in those of less power of flight. Conversely, other things being constant, those birds in which the pectoral muscles form a larger percentage of the weight of the body, would have a greater power of flight.

This being true the question naturally rises: What is the variation in the development of the pectoral muscles for the different species of birds, and is this variation by natural families or by individual species?

In the solution of our problem the shape of the wing plays an important part. The long, narrow, sharp-pointed wing is most advantageous to continued flight, and the shorter, rounded, less-compact form is least so. Between these two extremes there is an indefinite shading of the one form into the other, with more or less resulting advantage as the case may be.

The pectoral muscles may be relatively large, yet if the wing be of impeding form, so that considerable force is lost in overcoming the consequent disadvantage, the resulting power of flight is much lessened.

In this paper I have taken the weight of the whole body as a constant basis and found the percentage by weight of the pectoral muscles in the body. The data are derived from the dissection of 119 birds, having in all cases possible taken an average for each species from three individuals.

There are represented seven orders, twenty-five families and fifty-three species. It will be seen that variation is not by natural families but by individual species. This is explained by the fact that though certain species may have structures so allied as to join them together in a family, yet because of their distinct habits of life they may differ considerably in their power of flight.

List of species examined, arranged in order of percentage of pectoral muscles to total weight of body:

Broad-winged hawk *Buteo pennsylvanicus.*	5.98	per cent.	Maryland yellow-throat *Geothlypis trichas.*	7.50	per cent.
Screech owl *Scops asio.*	6.14	"	Blue-jay *Cyanocitta cristata.*	7.68	"
Mallard duck *Anas boschas.*	6.68	"	Song sparrow *Melospiza fasciata.*	7.84	"
House wren *Troglodytes ædon.*	6.87	"	Mud hen or coot *Fulica americana.*	7.89	"
Cat-bird *Mimus carolinensis.*	7.12	"	Brown thrush *Harporhynchus rufus.*	8.00	"

Loggerhead shrike........8.04 per cent.
Lanius ludovicianus excubitorides.

Red-headed woodpecker...8.21 per cent.
Melanerpes erythrocephalus.

White-throated sparrow....8.31 "
Zonotrichia albicollis.

Chewinck................8.60 "
Pipilo erythrophthalmus.

Olive-backed thrush.......8.73 "
Hylocichla ustulata swainsoni.

Cliff swallow.............8.74 "
Petrochelidon lunifrons.

Summer warbler..........8.76 "
Dendræca æstiva.

White-bellied nuthatch.....9.03 "
Sitta carolinensis.

Purple martin.............9.19 "
Progne subis.

Ruddy duck..............9.33 "
Erismatura rubida.

Orchard oriole............9.42 "
Icterus spurius.

Baltimore oriole...........9.51 "
Icterus galbula.

Blue-winged teal..........9.58 "
Querquedula discors.

Rose-breasted grosbeak.....9.66 "
Habia ludoviciana.

Titmouse.................9.78 "
Parus atricapillus.

Fox sparrow..............9.87 "
Passerella iliaca.

Snow-bird............... 9.97 "
Junco hyemalis.

Crow blackbird.......... 9.99 "
Quiscalus versicolor.

Belted kingfisher.........10.03 "
Ceryle alcyon.

Tree sparrow.............10.03 "
Spizella monticola.

Blue-bird................10.05 "
Sialia sialis.

Gold'n-wing'd w'dpecker10.09 per cent.
Colaptes auratus.

Wild goose.............10.22 "
Branta canadensis.

Meadow lark...........10.34 "
Sturnella magna.

Red-eyed vireo.........10.40 "
Vireosylvia olivacea.

Field sparrow..........10.55 "
Spizella pusilla.

Scarlet tanager.........10.65 "
Pyranga rubra.

Chimney swift..........10.75 "
Chætura pelagica.

Pigeon................11.09 "
Ectopistes migratorius.

Chipping sparrow........11.14 "
Spizella socialis.

Black-throated bunting..11.23 "
Euspiza americana.

Robin.................11.41 "
Turdus migratorius.

American goldfinch......11.43 "
Astragalinus tristis.

Cow-bird..............11.50 "
Molothrus ater.

King-bird.............11.61 "
Tyrannus carolinensis.

Wood duck............11.91 "
Aix sponsa.

Wood pewee...........12.10 "
Contopus virens.

Green-winged teal......12.14 "
Nettion carolinense.

Shore lark............13.32 "
Otocoris alpestris.

Quail.................14.99 "
Ortyx virginianus.

Ruffed grouse.........15.51 "
Bonasa umbellus.

Mourning dove........16.33 "
Zenædura carolinensis.

From the following comparisons of the hen and the goose with the nearest allied wild species which I have been enabled to obtain, the results of domestication as affecting pectoral development is readily seen:

Ruffed grouse (*Bonasa umbellus*)	15.51	per cent.
Hen	4.66	"
Wild goose (*Branta canadensis*)	10.22	"
Tame goose	6.40	"

I do not claim that from this list the exact place of a bird can be given as to its power of flight, because other elements than the size of the pectoral muscles enter into this complex problem so as to preclude an absolute classification on the basis of pectoral development, yet I think that there is a relative variation expressed by the figures given in this list, and that when together with this element the other elements of flight are considered we can tell the place a bird should occupy in the scale of flight.

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GEOLOGICAL EXTINCTION AND SOME OF ITS APPARENT CAUSES.

BY A. S. PACKARD.

IN his Origin of Species, Darwin says: " The extinction of species has been involved in the most gratuitous mystery. Some authors have even supposed that, as the individual has a definite length of life, so have species a definite duration. No one can have marveled more than I have done at the extinction of species." Finally, he remarks, " Thus, as it seems to me, the manner in which single species and whole groups of species become extinct accords wells with the theory of natural selection. We need not marvel at extinction; if we must marvel, let it be at our own presumption in imagining for a moment that we understand the many complex contingencies, on which the existence of each species depends. If we forget, for an instant, that each species tends to increase inordinately, and that some check is always in action, yet seldom perceived by us, the whole economy of nature will be utterly obscured. Whenever we can precisely say why this species is more abundant in individuals than that; why this species and not another can be naturalized in a given country; then, and not till then, we may justly feel surprised why we cannot account for the extinction of any particular species or any group of species."

The fact of extinction is indeed not less marvelous than that of evolution, and one cannot in these days feel satisfied that the solution of the problem lies in the theory of natural selection, which accounts for the preservation of species rather than their origin or extinction. Mr. Darwin having been the means of bringing many naturalists to believe in the theory of descent, they are not to lie supinely on their backs, resting securely on the dogma of natural selection and cease from all attempts to investigate the cause of evolution, to cease building a foundation for the working of natural selection. On the contrary the search for the causes of the transformation of species will be carried on with more energy, thoroughness and success. The clews which we already have discovered will be followed up, and finally we shall, by means of observation in the field and experiment in the laboratory, wrest from nature the secrets of life and its origin, and of the phenomena of death and extinction, not only of species but of orders.

Extinction may be both slow and rapid, the causes of each being primarily dependent on slow or rapid changes in the environment. The object of this article is to endeavor to show that the extinction of species is intimately connected with geological changes. It is a meagre sketch or outline of the more salient facts and laws which appear to us to immediately bear upon this intricate and difficult subject.

In Palæozoic times the climate of the globe was far more uniform than now. The continents of the present day were then of much less extent, in fact archipelagoes rather than continents; the land-surfaces were of moderate height, and mountain ranges smaller and lower. While the land masses or embryo continents of the eastern and western hemispheres were more or less independent centers of evolutionary creation, there was on the whole a great uniformity of plant and animal life. Species were perhaps more cosmopolitan than now.

When at the end of the Coal period the process of continent-making and mountain-building became greatly accelerated, resulting in that stupendous crisis in American geological history, the upheaval of the Appalachian mountain system, there must have been some degree of differentiation or setting aside of portions of the then continent into distinct areas or basins bounded by mountains, inland seas and rivers, and some slight subdivision into local faunas. We know that there was a distinct coal basin, or series of them, for example in Arctic America, another in Northeastern United States, and in the Central States of the Upper Mississippi valley.

Other crises, extending over comparatively brief periods of geological time, however long when measured by centuries, were the elevation of the Rocky mountains, of the Wasatch, the Uintah ranges, the Sierra Nevada and Cascade ranges; and, meanwhile, the union of the Atlantic moiety and the Pacific moiety of our continent into a continuous land-mass. These periods of activity, signalized by extensive volcanic outpourings and great changes in the relative distribution of land and sea, must have been, as palæontology shows, periods of rapid extinction as well as of reparation or recreation. Progress in continent-making was accompanied by progress and an onward sweep in the tide of life, not only in animals with jointed bodies and limbs, but more especially in those with back bones and brains to correspond with their vertebrate rank.

Until the end of the Tertiary period the earth's climate was still nearly uniform. There was through the Miocene a general, indeed most remarkable resemblance between the flora of Europe and the United States, with that of Greenland and Spitzbergen, or the regions now lying in the frigid zone; this flora being in some respects like that of Louisiana.

It was not until the Glacial epoch that the earth's climate became differentiated into tropical and frigid and temperate zones. That great geological crisis, whether due to astronomical or geological causes, or both combined, by which over enormous tracts of land in Northern and Central Europe, and Northeastern America a frigid climate, with continental glaciers, was spread—that crisis produced results on the life of the glaciated region which we can easily appreciate. The extinction of life over the stated areas became widespread. The incoming of the Ice age also must have induced extensive migrations to the southward. As the glaciers melted, and the climate ameliorated, fresh migrations from the south set in, and thus in the early Quaternary period, when species were exterminated on a vast scale by causes readily appreciable, we have set before us, in a language which every one can translate, some of the geological causes of extinction, modification and consequent evolution of new forms.

We will begin, then, with a reference to the changes in the life of the northern and southern hemispheres due to the glacial period. They are so familiar to the general reader that they need not detain us long.

By the end of the Tertiary period the northern regions, including the land around the north pole, viz: Spitzbergen, Novaya-Zemlya, Siberia, Greenland, together with Northern Europe and Northeastern America, must have abounded in life. Forests of trees, deciduous, evergreen and palmaceous, in their general appearance resembling those of Louisiana, spread like a mantle over the land, bordering the vast Tertiary lakes and sheltering herds of herbivorous mammals, such as deer, oxen, mammoths, which were attended by packs of dogs, or by solitary secretive cats prowling through the forest glades, waging war on the weak and defenceless or scattered ruminants.

This rich assemblage of mammalian life, with countless species of insects, and other invertebrate organisms, land, fresh-water and marine, was swept away. A large proportion died outright, perhaps a larger proportion migrated southward; a very small per centage survived. The mammoth and mastodon lived on, adapted themselves to the great change of climate, but just as the ice had passed away and the climate had ameliorated, and when the condition of life seemed more favorable, they succumbed. The Arctic bear, fox, lemming and hare, with the white ptarmigan and snowy owl, by adaptation to a snow-clad land survived, so to speak, the change, or rather, they are the descendants of species so plastic that they became modified, and adapted to an Arctic life. Even man, who appeared in the old world before or about the time of the incoming of the ice, not only followed the retreat of the glaciers, but adopted a strange sort of existence in a region where the climate has a mean annual temperature of less than 32° F. Wherever the Eskimo lived he found the walrus and seal, the modified relatives of the sea lions and sea elephants of other parts of the world. The profusion of Tertiary insect life was succeeded by a scanty assemblage of Arctic butterflies, moths, bees and other stragglers from the temperate regions.

The forests died outright, and where Sequoia, the sweet gum, the palm and other luxuriant semi-tropical trees flourished, now grow the dwarfed birch, willows and low herbs of Alpine and Arctic barrens. It is sufficiently manifest that the circumpolar flora and fauna are the dwarfed, or otherwise modified descendants of the Pliocene-Tertiary life of the same regions. Again, peculiarities in the distribution of plants and animals in North America and Northern Eurasia indicate strongly that there was an extensive migration southward down the Atlantic and Pacific borders of the continents as the glacial cold crept over the once populous circumpolar regions.

A second series of causes of extinction arose from the elevation or depression of extensive regions of the earth. The paroxysmal, elevatory process in the formation of the Cordillera of North, and particularly South America, involved corresponding more or less rapid changes in the flora and fauna of the Pacific Coast regions of those continents. In South America, particularly, during the Quaternary period, though there was no glacial period north of Patagonia, the extinction of life was widespread and marked.

As observed by Darwin and Alexander Agassiz, within historic periods there have been paroxysmal upheavals over thousands of square miles, if not over the whole extent of the Western Andean plateau.

For example, in 1822, after an earthquake, the coast line of Patagonia and Chili was suddenly elevated from two to seven feet above the level of the ocean. In 1835 Darwin, while at Valdivia on the coast of Chili, experienced the earthquake which devastated Conception, and he says his "compassion for the inhabitants was almost instantly banished, by the surprise in seeing a state of things produced in a moment of time, which one was accustomed to attribute to a succession of ages. In a single day, Feb. 20th, this earthquake shook the coast of South America over an area of 600,000 square miles, and the whole coast line of Chili and Patagonia was elevated from two to ten feet above the sea level." Darwin in his Voyage of a Naturalist remarks: "At the island of S. Maria (about thirty miles distant), the elevation was greater; on one part, Captain Fitz Roy found beds of putrid mussel-shells *still adhering to the rocks*, ten feet above high-water mark; the inhabitants had formerly dived at low-water spring-tides for these shells. The elevation of this province is particularly interesting from its having been the theatre of several other violent earthquakes, and from the vast numbers of sea-shells scattered over the land, up to a height of certainly 600 and, I believe, of 1000 feet. At Valparaiso, as I have remarked, similar shells are found at the height of 1300 feet; it is hardly possible to doubt that this great elevation has been effected by successive small uprisings, such as that which accompanied or caused the earthquake of this year, and likewise by an insensibly slow rise, which is certainly in progress on some parts of this coast." Darwin adds: "Two years and three-quarters afterwards, Valdivia and Chiloe were again shaken, more violently than on the 20th [Feb. 20, 1835], and an island in the Chonos archipelago was permanently elevated more than eight feet."

As observed by Mr. A. Agassiz, there are sea corals of species still living in the Pacific ocean adjacent, attached to the surface of interstices in the rocks at Tilibiche, Peru, at a point about 2900 feet above the level of the sea. This locality is situated on a ridge parallel to the coast, there being a pampa or basin between this ridge and the coast range. This basin was probably the bottom of an internal sea which afterwards became a salt lake, and was eventually drained into the Pacific by the breaking through of the mountain barriers. The extensive saline basins on the western slope of the Andes, at an elevation of over 7000 feet, may have been former ocean bottoms. In his Andes and the Amazon, Orton says: "President Loomis of Lewisburg University, Pa., informs the writer that in 1853, after nearly a day's ride from Iquique, he came to a former sea-beach. It furnished abundant specimens of Patellæ and other shells, still perfect, and identical with others that I had that morning obtained at Iquique with the living animal inhabiting them. This beach is elevated 2500 feet above the Pacific." (p. 116.) Also, the presence of a species of Amphipod Crustacean belonging to "a truly marine family," dredged by M. Agassiz in Lake Titicaca at a depth of sixty-six fathoms, indicates that this lake may be a remnant of the Pacific ocean; though it now stands at an elevation of 12,500 feet above the sea.

These facts tend to prove that the Andean plateau during the Quaternary period was paroxysmally elevated into the air some 12,000 feet. Let us now look at the possible results of such an enormous upheaval on the plants and animals of this region. Before and at the time this movement began, when the land was 12,000 feet lower than now, the Atlantic trade winds which now cross Brazil, impinge upon the Andes and drop their moisture on the eastern slopes alone, then favored as well the western slopes and Pacific coast. The tropical flora and fauna now confined to the neighborhood of Guyaquil on the coast of Peru then probably spread over Bolivia, Ecuador, Peru and Chili to Patagonia. The tropical belt in Peru ends with the chinchona forests of Loja, which is 6768 feet above the Pacific ocean. The sugar cane grows in Baños which is about 6500 feet high. At Riobamba, with an elevation of 9200 feet, the climate and vegetation are temperate; here occur bones of the mastodon, horse, deer and llama—animals which may have lived in a temperate climate. But was not their extinction, and that of the colossal sloths, armadillos, and other animals of the pampas largely due to a change of climate resulting from the elevation of the Andean plateau?

As the land gradually rose, the atmosphere would become more rarified and insupportable to tropical life; the animals and plants would either seek lower levels or undergo extinction, or in certain cases become modified into species suited to a temperate climate. As the plateau rose still higher, the air would become too cold and rarified for even the mastodon and horse. Gradually an alpine zone became established, and finally the higher peaks of the Andes, at an elevation of 15,000 feet, became mantled with perennial snow, and on the eastern flanks of Chimborazo, which intercepts the moisture of the Atlantic trades, glaciers established themselves. We thus see how, within Quaternary times, temperate and alpine zones became established over the vast Andean plateau, originally, perhaps at the end of the Pliocene, a plateau of the third order, clothed with vast forests like those of Brazil and Venezuela.

In Patagonia, likewise, the elevation of the Cordillera, and the change of level of the low lands of the eastern coast, now well-known to have happened, are they not sufficient to account for the extinction of the fauna of the pampas?

The same phenomena obtained in Western North America. Throughout the Tertiary period there was in the northern portion of the plateau region a secular rise of land, if not at times paroxysmal, resulting in the drainage of the plateau into the Pacific and the formation of vast inland seas and estuaries which eventually became fresh-water lakes.

During the Laramie epoch the Rocky mountain plateau became dry land, and the elevation and drainage went on during the Eocene. The Gulf of Mexico was much larger in the Eocene epoch than now; afterwards the coast of Texas rose from 300 to 700 feet, while farther north, in Colorado and Wyoming, the Rocky mountain plateau rose from 4000 to points 10,000 feet above the ocean.

The plains east of the Rocky mountains are underlaid by beds deposited by vast inland, fresh-water lakes. In Texas these beds dip under the Gulf of Mexico, but at the base of the Rocky mountains in Colorado they are 7000 feet above the sea. They have been tilted up. Gen. Warren and Mr. King have shown that after the Pliocene epoch such a tilting took place. These lakes dried up, and the marvelously abundant mammalian life which thronged about their shores became extinct as the Quaternary period opened. May not the extinction of life so widespread throughout the West, particularly at the end of the Eocene, the Miocene and the Pliocene, have been mainly due to the great changes in the physical geography of that vast region? We see also why a semi-tropical climate and flora and fauna continued to exist around the Gulf of Mexico, but ceased to live on the elevated Rocky Mountain plateau, as well as the Sierra Nevada and Cascade plateaus. The whole western portion of the continent was carried up bodily, the lakes drained off by the Missouri, Columbia and Colorado rivers and the air at such an elevation becoming rarified, dry and cooler, the tropical life became either extinct or migrated southward to warmer and lower regions. Towards the end of the Pliocene multitudes of llamas, droves of horses, mylodons, elephants and mastodons, with lions, cats and dogs, flourished in Oregon, Montana, Utah, Wyoming, Colorado and New Mexico; changes of level and consequently of climate were perhaps the main factors concerned in their demise.

There were throughout the Tertiary most widespread and all pervading geological changes, culminating in the upheaval of the two great mountain chains of the West. Horizontal Cretaceous strata lie on the Rocky mountains at an elevation of 10,000 feet, the sign and proof of an extensive upheaval. We know that the movement in South America, while gradual for the continent, was more or less locally paroxysmal. Was it not the case also in North America?

By the end of the Pliocene, North America assumed its present continental proportions. The Rocky mountains and Sierras shot their peaks into the sky to elevations of 10,000 and 15,000 feet above the Pacific. These great walls shut off the moist trade winds from the Pacific, a period of dessication set in throughout the great basin between the Rocky mountains and Sierra Nevada, and extensive rainless districts resulted. But even then there were alternate wet and dry cycles throughout the early Quaternary. Great Salt Lake, from being a vast body of fresh water, became a shallow brine pool; the sources of the Colorado, Columbia and their tributaries likewise partially dried up.

Finally, the Glacial epoch came in, the glaciers invaded Northeastern America; these on the one hand, and the great elevation of the western plateau, seem to have been the causes which removed the Pliocene fauna; which removal was, geologically speaking, comparatively sudden.

Either at the end of the Pliocene or beginning of the Quaternary, as seen by the bones in the Port Kennedy cavern described by Professor Cope, there was a singular mixture of what we now regard as tropical and temperate forms living so far north as Pennsylvania; with the tapir, peccary, Mylodon, Megalonyx, Castoroides and sabre-toothed tiger, were apparently associated the deer, bison, horse, porcupine, raccoon, dog, weasel and smaller mammals. The fauna was in part extinguished by the glacial cold, Port Kennedy being situated a little south of the edge of the great glacier.

The result of a change of climate was a change in the nature of the forests; the tapir and peccary were forced to migrate southward; the colossal sloth and sabre-tooth tiger died outright; the Castoroides, horse and mastodon lingered through the Glacial epoch, their remains being found at the bottom of swamps, but above the glacial and river drift; while the deer, bison, raccoon, dog or wolf, and other forms survived with unimpaired vigor and became adapted to a lower climate, forming the typical members of the north temperate fauna of America.

Farther south, in the river gravels and caves of the Middle and Southern States, are found the bones of the great sloths, Megatherium, Megalonynx and Mylodon, the American lion and bear; these were possibly swept out of existence by the cooler winters of the Mississippi valley, which was free from ice, but probably had from their proximity to the great glaciers a lower climate than in Pliocene times.

Professor Cope remarks: "Since the Eocene, the mammalian fauna of the northern hemisphere has diminished in number of species and genera. The Eocene fauna was richer than the Miocene, the Miocene than the Pliocene, and the Pliocene than the modern fauna." There is certainly a significant parallelism between the widespread changes in the physical geography of North America, the differentiation of climates and of faunal areas, and the increasing extinction of life.

The West Indies meanwhile were the scene of notable changes in the distribution of land and sea. From being much larger, and in some cases connected perhaps with South America, they became submerged. Cope has described the fossil remains found in a cave on the Island of Anguilla. Out of twelve species of mammals, seven are extinct and several were chinchillas of large size.

About the shores of the Mediterranean there were remarkable changes in the relations of land and sea. The species of dwarf and other elephants whose bones have been discovered on the Island of Malta, show that within recent times that island must have been connected with the main African continent.

In the old world, simultaneously with the mountain-building of America, the Alps during the later Pliocene attained their present proportions; the Himalayas rose to their present heights; the continents of Asia, with Europe, and of Africa assumed their present outlines.

The extent and nature of the changes which took place late in the Pliocene in the physical geography of the globe were without doubt much greater than at any previous time in the history of our planet. While the present coast lines were being established volcanic agencies were widespread and powerful, and over what were then regions of intense volcanic activity are to be now seen but the dying embers of subterranean fires.

The long, quiet preparatory eons of the Mesozoic and early Tertiary, were succeeded by a crisis in geological history, just as the comparative quiet of the Palæozoic age terminated in the widespread disturbances which took place at the end of the Coal period.

If we glance back through the geological ages we shall see that there were cases of the comparatively rapid extinction of types or whole groups of animals. The more remarkable were the extinction of the trilobites and ammonites. Darwin remarks: "The extermination of whole groups, as of ammonites toward the close of the secondary period, has been wonderfully sudden."

In the same manner the trilobites as well as the Eurypterida ceased to exist at the end of the Palæozoic age; the Silurian graptolites disappeared with comparative suddenness; the crinoids and brachiopods mostly, and the dinosaurs and ornithosaurs, as well as pythonomorphs wholly perished during the Cretaceous period.

The views we have presented, while opposed to ultra-uniformitarian ideas, have nothing in common with the Cuvierian catastrophic doctrine of sudden, wholesale extinctions and re-creations. But known facts in palæontology postulate long periods of quiet preparation, succeeded by more or less sudden crises, or radical changes in the physical structure of continents, resulting in catastrophies, both local and general, to certain faunas or groups of animals, as well as individual species.

The biological changes were not due to climatic and geological changes alone, but it should be borne in mind that the great changes, slowly induced but not without striking final results, ending in the addition or loss of vast areas of land, induced extensive migrations, the incursions of prepotent types which exterminated the weaker. The reaction of one type of life upon another, the results of natural selection, were apparent all through; but these secondary factors were active both during periods of quiet and periods of change. Here again we may quote from Darwin, the leader, next to Lyell, of the uniformitarian school, who remarks: "We have every reason to believe, from the study of the Tertiary formations, that species and groups of species gradually disappear, one after another, first from one spot, then from another, and finally from the world. In some few cases, however, as by the breaking of an isthmus and the consequent irruption of a multitude of new inhabitants into an adjoining sea, or by the final subsidence of an island, the process of extinction may have been rapid."

Local extinctions due to local changes of level; the formation of deserts, saline wastes and volcanic eruptions and vast outpourings of lava, such as took place in Oregon and Idaho during the Tertiary, with sub-marine earthquakes causing the death of fishes on a vast scale, these are quite subordinate factors.

In closing this meager sketch of a subject which has not received very much attention, we have endeavored to attract notice to what we have been accustomed to regard as the main factors in the extinction of species and of higher groups. That there is a limit to the age of species as well as to individuals almost goes without saying. As there is in each individual a youth, manhood and old age, so species and orders rise, culminate and decline, and nations have risen, reached a maximum of development and decayed. The causes, however complex, are, in the case of plants and animals, apparently physical; they are general and pervasive in their effects, and have been in operation since life began; there have been critical periods in palæontological as well as geological history, and periods of rapid and widespread extinction as well as a continual, progressive dying-out of isolated species. Such extinction was, so to speak, a biological necessity, for otherwise there would have been no progress, no evolution of higher types.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

——In entering upon the twentieth year of the publication of this magazine, the friends of the undertaking may congratulate themselves on its signs of good health and strength, as seen in the portly appearance of the later volumes. Having passed through the perils of infancy and childhood, may we hope that in entering upon years of maturity it will, with each volume, gain in strength, and character as an exponent of American natural science.

While the magazine has doubled in size, the number of departments and of assistant editors has correspondingly increased. More space is given to reports of scientific discoveries so as to render the magazine more useful to science-teachers, and the working naturalist.

Our great need is, more numerous plates and cuts; to secure this end our friends are urged to aid in enlarging our subscription list.

Our hearty thanks are due to the public for its support, and to our contributors and assistant editors. Depending on their aid and good will we hope to make the future volumes of the NATURALIST still more deserving of public support and esteem.

——The proposition to create an Academy of Sciences of the State of Indiana, suggests some reflections as to the future of such bodies in the United States. It has appeared to us desirable that each State should have, at some future time, its academy of sciences, but we have refrained from enlarging on the topic, since it is plain that, as regards the greater number of States, the time has not yet arrived. But Indiana now comes to the front, and if she succeeds in establishing a real academy of sciences, she will hold the place of honor in our history. There is no doubt that among the men of her leading schools, her geological surveys, etc., she has the material for the organization of such a body. In most of the States there is no material out of which to make an academy of sciences, and in none is there much material.

Of course all are agreed that merit only shall be the test of membership in such a body; but all are not agreed as to what the test of merit ought to be. There can, however, be but one test, and that is the one which has been adopted in the old countries, and by our own National Academy in recent years, and that is the test of *meritorious work done.* It may be that this is an imperfect guide to the merits of some men, but it is the best we have, and the one open to the fewest objections. Moreover the estimation of the merit of work done should be guided by the attribute of quality rather than of quantity, and chiefly by the quality of originality or novelty. There are many meritorious compilations, but the best of them stand in the second rank of merit. The first rank is held by the discovery of new truths. As the amount of truth yet to be learned far exceeds that which has been acquired hitherto, its discovery is the business of the scientific man. Since the truths that lie at the foundation of a majority of phenomena are yet unknown, the work of compilation had better be left to those who for any cause whatever are incapable of original research.

In the first organization of an academy of sciences, the seeds of its future success or failure are sown. The admission of persons to membership who regard science as a mere ornament, or amusement, will vitiate its future life. Still more will the entrance into its councils of persons who regard membership merely as a step to personal advancement. In many portions of this country, especially in some regions where intelligance is not wanting, the fact of the specialization of men's abilities is not sufficiently admitted. In such communities it is still believed that, intellectually speaking, "all men are born equal," or nearly so. In such places a fluent expression of interest in some form of human progress, will be regarded as identical with ability to aid in that form of human progress.

Since academies of sciences in this country are not yet sustained by government grants, it will be necessary to have a lay membership, whose annual dues will meet the necessary expenses. There should therefore be two degrees of association, viz., membership and fellowship; the latter to be conferred exclusively on persons who have contributed important work to the progress of science, chiefly of original research. Such fellowship becomes an order of merit, which serves both as a stimulus and as a reward for work.

The local academies of science hitherto established, generally possess libraries and museums. This property may become a great evil, as, for instance, when its conservators claim equal place in the councils of the academy with the scientific men. But it could be administered by a financial or property committee of lay members, who should act with the fellows, when management of financial matters is in question.

—— The numbers of the AMERICAN NATURALIST for 1885 were issued at the following dates: January, Dec. 30th, 1884; February, Jan. 19th, 1885; March, Feb. 24th; April, March 21st; May, April 20th; June, May 18th; July, June 20th; August, July 28th; September, Aug. 15th; October, Sept. 22d; November, Oct. 23d; December, Nov. 25th.

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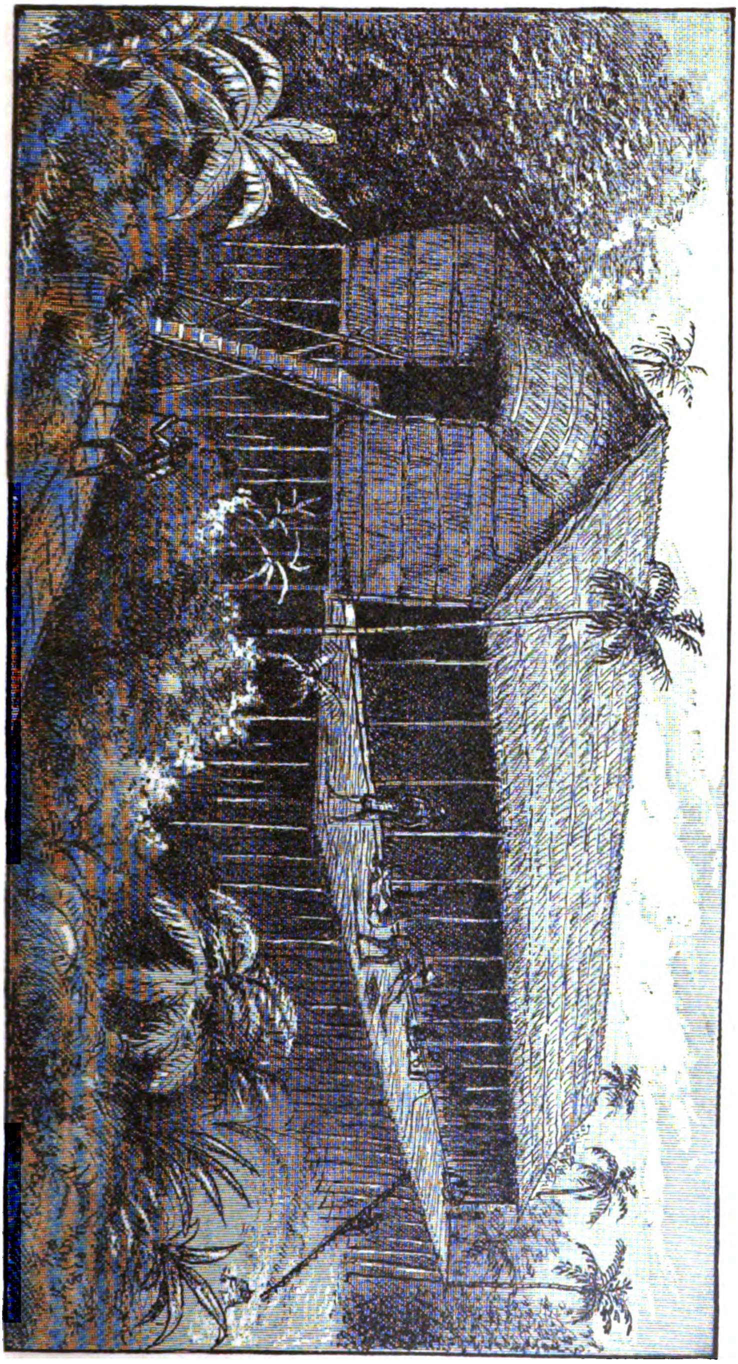
RECENT LITERATURE.

HORNADAY'S TWO YEARS IN THE JUNGLE.[1]—The author spent two years in the East Indies dividing his time between India, Ceylon, the Malay peninsula and Borneo, collecting specimens for Ward's establishment at Rochester. Wherever he went Mr. Hornaday kept his eyes open. Of apparently a hardy, iron constitution, which was not subdued by repeated attacks of the jungle fever, of great industry and bravery, and withal a good story-teller, the result is one of our best books of travel in countries which have been ransacked by English and German travelers. The interest of the narrative is sustained throughout, and if at times too much slang is introduced, we forgive these slight derelictions in view of the manifest honesty, kind-heartedness and scientific zeal of the author. Though by profession a taxider-

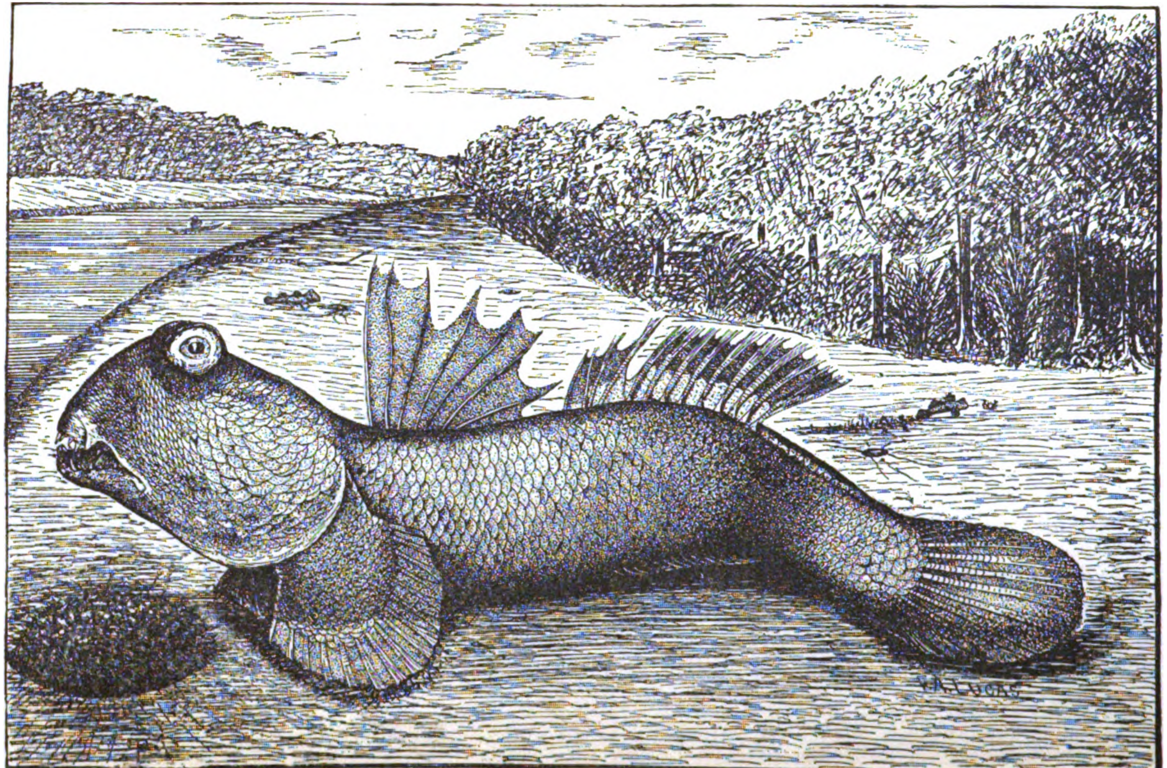
[1] *Two Years in the Jungle.*—The experiences of a hunter and naturalist in India, Ceylon, the Malay peninsula and Borneo. By WILLIAM T. HORNADAY, with maps and illustrations. New York, Charles Scribner's Sons. 1885. 12mo, pp. 512. $4.00.

PLATE II.



EXTERIOR OF SEA DYAK LONG-HOUSE.

(Sketched by the Author.)



THE JUMPING FISH.—(PERIOPHTHALMUS SCHLOSSERII.)
(*Drawn by F. A. Lucas, from a specimen.*)

mist and collector, Two Years in the Jungle abounds in observations on the physical geography, ethnography, zoölogy and botany of the countries visited. We get a clear idea of Western India, its people, their castes, of British rule, on the whole so beneficent, as well as how to skeletonize elephants, skin monkeys, crocodiles, tigers, snakes and orangs. The maps are convenient and the illustrations numerous, new and fresh, if not always excellent from an artistic point of view. These which we have been permitted to introduce are fair specimens of the plates. Among the more valuable contributions to zoölogy are the portions refering to the elephant, its natural history and psychology, the crocodiles and gavials, the orangs and gibbons, the sharks, particularly that strange connecting link between the sharks and skates, Rhamphobates, down to the jumping fish. If Mr. Hornaday in slaying elephants showed rare nerve and skill as a marksman, quite another set of qualities were brought into play in catching these odd fish. These creatures live on the mud flats of the Siamese rivers, hopping about over the deep mud, feeding on the tiny crustaceans left on the bank by the receding tide; but we will let the author tell the story in his own way:

"The Malays were thunderstruck when I pulled off my shoes and told them to put me ashore. Seeing that I was really going, Francis, like a good boy, did not hesitate to follow, and we stepped out of the sampan into mud and water hip deep.

"We will never know the actual depth of the mud on that bank, but we sank into it to our knees at every step, and were fortunate enough to stop sinking at that point. What a circus it must have been for those who looked on! But, in for a penny in for a pound, and bidding Francis choose the largest fish when possible, we went for them. There were probably a dozen in sight, hopping spasmodically about, or lying at rest on the mud, but when we selected the nearest large specimens and made for them, they developed surprising energy and speed, and made straight for their burrows. They progressed by a series of short but rapidly repeated jumps, accomplished by bending the hinder third of the body sharply around to the left, then straightening it very suddenly, and at the same instant lifting the front half of the body clear of the ground by means of the arm-like pectoral fins which act like the front flippers of a sea lion. These fins are almost like arms in their structure and use, the bones being of great length, and thus giving the member great freedom of movement. Owing to the soft and yielding nature of the mud the leaps were short, about six inches being the distance gained each time, but they were so rapid, the mud so very deep and our progress so slow, the fish always succeeded in getting into their holes before we could reach them. Their burrows were simply mud holes, going straight down to a depth of three to four feet, large enough in diameter to admit a man's arm easily, and, of course, full of water. Although the mud was soft, it was not sticky, and we were able to use our hands for spades very effectually. By digging a big hole two feet deep, and standing on one's head in the bottom of it, we were able to reach an arm down two feet farther and seize our fish at the bottom of the burrow. Lucky it was for us that they had no sharp and poisonous spines, like the mud-laff which stung me in Singapore and paralyzed my right hand for some hours.

"My first fish was hard to get and hard to hold, but in the immortal words of *The Shaughraun*, 'Begorra, 'twas worth it.'"

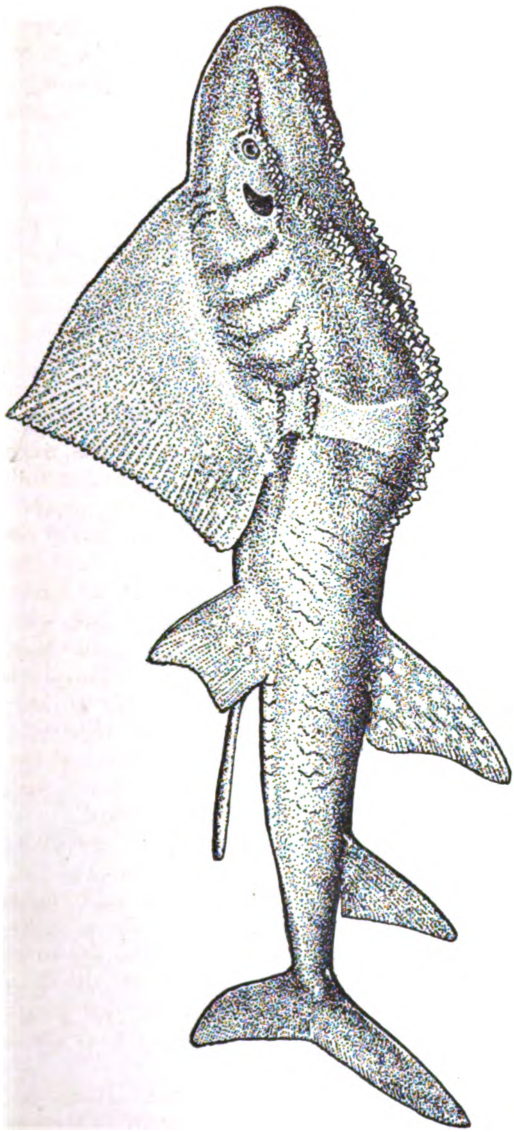
In hunting tigers and elephants, the most dangerous game in the world, Mr. Hornaday proved himself a mighty Nimrod. He naturally has much to say of the elephant, and we are surprised to learn that in such a populous country as India the animal is on the increase. Though at present they are rigidly protected by law, it is evident that their number will soon increase to such an extent "as to render further elephant shooting positively necessary."

The height of the Indian elephant is, the author claims, like that of nearly all large animals, usually recorded in exceptional figures. "Even the best scientific writers are apt to fall into the habit of giving the largest measurements fairly obtainable, which therefore brings the average animal far below the standard they set up. I can scarcely recall an instance of having shot a mammal, even out of a score of the same species, which came up to the measurements recorded by Jerdon in his Mammals of India. The height of the male *Elephas indicus* should be recorded as nine feet six inches, vertical measurement, at the shoulder, and the female eight feet, for these figures represent the height of from eight to twelve individuals to be found in every hundred; in other words, animals which can be seen without searching throughout the length and breadth of India."

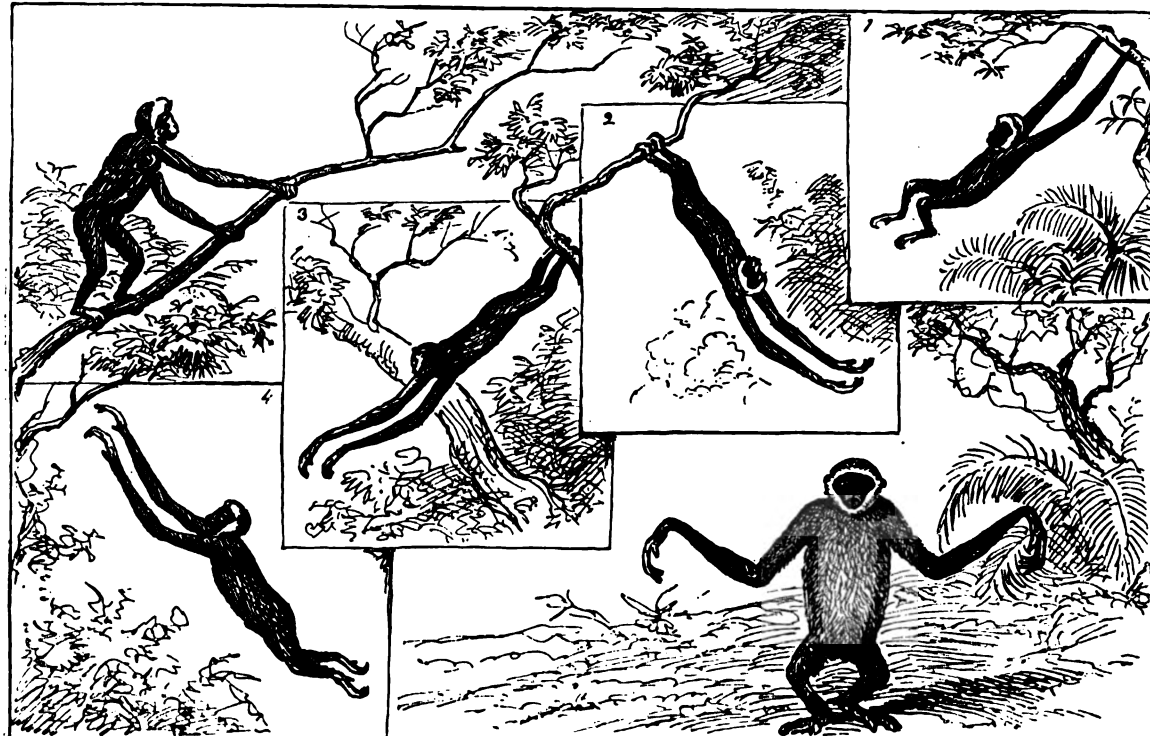
The height of the Indian elephant is everywhere recorded as from ten to ten and a half feet, but the largest one ever measured "was a tusker described by Mr. Corse in 1799 as belonging to Asaph-ul-Daula, a former Vizier of Oudh, which really measured ten feet six inches, perpendicularly at the shoulder. This animal was merely one out of ten thousand, and it would be quite as sensible to measure Chang and record the height of Chinamen as being seven and a half feet, as to say that the Indian elephant is as tall as the Vizier's giant."

Our author spent a month with the Dyaks in Borneo, orang hunting, his trophies now adorning the National Museum at Washington. His account of the two species of orang (*Simia wurmbii* and *satyrus*) inhabiting Borneo, is detailed, and stamped with the mark of accuracy. The nesting habits were observed and described as follows: "I got there just in time to see the orang build a large nest for himself. He took up a position in a

PLATE IV.



RHAMPHOBATIS ANCYLOSTOMUS. (GILL.) *(From a sketch by the Author.)*



THE GIBBON'S MODES OF PROGRESSION. *(From sketches by the Author.)*

1-4. Swinging through the tree-tops.—5. Walking on level ground.—6. Climbing through the tree-tops.

fork which was well screened by the foliage, and began to break off small branches and pile them loosely in the crotch. There was no attempt at weaving, nor even regularity in anything. He reached out his long, hairy arm, snapped off the leafy branches with a practiced hand, and laid them down with the broken ends sticking out. He presently got on the pile with his feet, and standing there to weight it down he turned slowly, breaking branches all the while and laying them across the pile in front of him, until he had built quite a large nest. When he had finished he laid down upon it, and was so effectually screened from us that I could not dislodge him, and after two or three shots I told the natives they would have to cut the tree." During one day's travel along the Upper Simujan river, Mr. Hornaday counted thirty-six old nests and six which were regarded as new or fresh. He thinks that an orang after building a nest sleeps in it several nights in succession, unless he leaves its neighborhood altogether. He never saw nor heard of any house-building by orang-utans, though he was led to believe that some individuals may have a habit of covering their bodies with branches for protection against the dashing of the rain drops during a heavy storm. "My little pet orang," he says, "would invariably cover his head and body with straw or loose clothing the moment it began to rain, even though he was under a roof."

Forty-three orangs were shot by Mr. Hornaday and his hunters, and of these seven exceeded the maximum height as given by Mr. Wallace, viz., four feet two inches. "My tallest *Simia wurmbii* or 'mias chappin,' measured four feet six inches from head to heel, and the next in size four feet five and a half inches. Then a *satyrus*, or 'mias rombi,' measured four feet four and a half inches, two other *wurmbii* four feet four inches, and four feet three inches respectively, a *satyrus* four feet three inches, and a *wurmbii* four feet two and a half inches."

The account of the gibbons and other animals of Borneo, its forests and of the Dyaks are interesting—indeed there is not a dull page in the book. Besides the general map there is an ethnographic map of Borneo, showing the distribution of the Dyak tribes and subtribes, as classified by the author. Much ethnographic material is given, with frequent illustrations. We see little in point of fact to criticise, except where the author speaks of nummulites as "little flat echinoderms."

GOODALE'S VEGETABLE PHYSIOLOGY.[1]—Early in the past year we had the pleasure of noticing the first part of this work, which is now completed by the appearance of Part II. The chapters in the part before us deal successively with, Protoplasm in its rela-

[1] *Gray's Botanical Text-Book* (Sixth Edition), Vol. II. Physiological Botany. II. Vegetable Physiology. By GEORGE LINCOLN GOODALE, A.M., M.D., Professor of Botany in Harvard University. Ivison, Blakeman, Taylor & Company, New York and Chicago, 1885. pp. XXI. 195 to 500+36. Illustrations 142 to 214.

tions to its surroundings; diffusion, osmosis and absorption of liquids; soils, ash constituents, and water culture; transfer of water through the plant; assimilation; changes of organic matter in the plant; vegetable growth; movements; reproduction; the seed and its germination; resistance of plants to untoward influences. The whole volume thus covers the field of the general anatomy and physiology of plants, and especially of the flowering-plants.

In looking over the chapters one is struck with the fact that in them much new material has been brought for the first time before the American student. There is thus a freshness about much of the matter which adds greatly to its interest. The treatment, too, is sufficiently different to distinguish the book at once from others covering the same general ground. Very naturally the work has much of the German method in it. In fact a great part of the matter is the result of work done in German laboratories.

A noticeable feature of the book is its wider range of subjects than is usual in botanical works. There is much in it which we are accustomed to consider as belonging to agriculture and agricultural chemistry. This feature will commend the book to the teachers and students in our agricultural colleges. We have thus in chapter VIII such topics as the following taken up and discussed at some length, viz: Formation of soils; classification of soils; condensation of gases by soils; temperature of soils; etc., etc. In chapter XVI we have discussed the following practical topics, viz: Winter killing; improper food; noxious gases; liquid and solid poisons; mechanical injuries.

The chapters which interest us most are the tenth, eleventh and twelfth, devoted respectively to assimilation, change of organic matter in the plant, and vegetable growth. In the first there is some danger of confusion from the double sense in which the word assimilation is used, viz: 1, For the conversion of all food-matter (in which sense it is employed in the heading to the chapter and headings of the pages throughout the chapter), and 2, the appropriation of carbon. This last is called assimilation proper (p. 285), and a few lines further on the statement is made that "the term *assimilation* in the following pages will be made to refer to the appropriation of carbon." Aside from this confusion of terms, the treatment is exceedingly satisfactory. In the eleventh chapter the word transmutation is used in place of the usual one, metastasis, or the less usual one, metabolism. This appears to us to be a desirable improvement in the nomenclature of the subject.

The chapter on vegetable growth brings before the student the latest results of the German investigators, and this is done in so clear and concise a manner as to leave nothing to be desired. The author has sifted the great mass of literature upon this subject and given in summary form the results.

The illustrations throughout the volume are drawn mainly from the publications of Pfeffer, Sades, Darwin and others, and in many cases have been reduced in size by the publishers so as to give them a better appearance upon the octavo pages. The printer's work has been well done, and the book has an attractive appearance.—*Charles E. Bessey.*

WOOD'S NATURE'S TEACHINGS.[1]—Mr. Wood has written a good many books on zoölogical subjects, all useful, but none of them particularly profound or especially inspiring, but we think that in the present case he has produced a most readable book. The object of the writer is to show the close connection between the actions of the different organs of animals and plants and human inventions, and to prove that there is scarcely an invention by man which has not its prototype in nature. The author has placed side by side a great number of parallels of nature and art, with terse, brief descriptions, and illustrated with a great number of original sketches. As a result, we have just the book to put into the hands of a boy, not only serving to interest him but to lead him to observe the common objects of nature; and grown-up people will also, if we mistake not, relish its pages and illustrations. The author draws the corollary from the facts presented, "that as existing human inventions have been anticipated by nature, so it will surely be found that in nature lie the prototypes of inventions not yet revealed to man."

As examples, the raft with its sail is anticipated by the Velella; the boat by the gnat-egg boat, the floating sea-anemone, or water-sail or pupa-skin of the mosquito; and the boatman in his boat by the "water-boatman," or Notonecta. Examples of paddle-wheels are seen in those of the Ctenophores, and the movements of the tail of the fish anticipate those of the propeller. The arrangement of the ribs of a fish are like those of a vessel, while the form of a ship's anchor is outlined in the spicule of the Synapta, and that of a grapnel in the spicules of sponges and Echinococcus; ice-anchors and ice-hooks are anticipated by the tusks of the walrus; an eagle's claw presages a flesh-hook, and the grapple-plant the ordinary drag; boat-hooks are typified in the pushing spikes of sea worms; Captain Boynton's life-dress in the float of a Portuguese man-of-war, and Janthina's raft in a cask-pontoon. Under the caption of war and hunting, pitfalls are shown to be but an imitation of that of the ant-lion, and poisoned arrows of the fangs of serpents and the stings of insects. Barbed spears, harpoons and arrows have multitudes of semblances in nature, as do projectiles of all descriptions. Nets, traps, defences of all sorts, armor of varied description, forts, scaling implements, tunnels, as well as the houses of savages, and the porches, eaves, windows, thatch, slates and tiles of civilized architecture, with

[1] *Nature's Teachings.* Human inventions anticipated by Nature. By Rev. J. G. WOOD, with upwards of 750 engravings. Boston, Roberts Brothers. 12mo, pp. 533.

girders, ties, buttresses, dovetailing, and varnish, all existed in nature before man conceived them. So with spades, scissors, chisels, the plane, saw, boring, striking and grasping tools. Philosophic toys, fans, water-rams and paper-making—in short, many of the arts of every-day life are the reflections of nature. The book is full of curious facts, and set forth in a plain, simple, attractive style.

REPORT OF THE STATE GEOLOGIST OF NEW JERSEY FOR 1884. Geo. H. Cook, Director.—From this report we learn that the geodetic survey of New Jersey is completed except in the interior of the southern part, and that the topographical survey has completed over three-fifths of the total area. The volume includes notices of the buried forest near South Amboy, consisting of chestnut, oak, cedar, etc., in complete preservation, and probably buried since the settlement of the country; of the glacial drift and yellow sand and gravel; of the continuation of the plastic clays, marls, etc., of the Cretaceous and Tertiary strata under the ocean for one hundred miles; of the now celebrated columnar trap rocks of Orange mountain; of the Devonian, Silurian and Archæan areas of Northern New Jersey; of the mines and mining industry; artesian wells, etc., of the State.

Perhaps the most interesting result given is that the slope of the sea bottom beyond the continental plateau is almost exactly the same as the dip of the Cretaceous strata. The presence of the Cretaceous beds in the marginal deposits of the ocean, as proved by borings, seems to prove the Pre-cretaceous age of the ocean bottom.

FOURTEENTH ANNUAL REPORT OF THE GEOLOGY AND NATURAL HISTORY SURVEY OF INDIANA. John Collett, Director.—This volume is accompanied by a geological map giving a fair exhibit of the surface geology of the State. The topographical and geological features of Madison, Hamilton, Fayette and Union counties, are given more in detail, and Dr. J. S. Newberry describes the drift deposits of the State. The volume closes with an account of the mammalian fauna of the Post-pliocene deposits, by Professor E. D. Cope and J. L. Wortman. The Artiodactyla are *Platygonus compressus* and *Cariacus dolichopsis;* the Proboscidea, *Elephas primigenius* and *Mastodon americanus;* while the Rodentia are represented by the singular *Castoroides ohioensis*, an animal exceeding the capybara in size, and, spite of its name, differing widely in character from the beaver. *Megalonyx jeffersoni* represents the sloth-like edentates, and the genus Equus has left the remains of two species, *E. fraternus* and *E. major*, in the Pliocene and Post-pliocene of Indiana.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

ASIA.—*The Trigonometrical Survey of India.*—At the meeting of the British Association, held at Aberdeen in September of this year, the president of the geographical section, General J. T. Walker, gave an account of the survey of Hindostan. Survey operations along the coast-lines began before the commencement of the seventeenth century, and the first general map of India, published by D'Anville in 1752, was compiled from the charts of coast-lines and the itineraries of travelers. Major Rennell, appointed surveyor of Bengal in 1764, was the father of Indian geography. In nineteen years he surveyed 300,000 square miles, and after his return to England, published a great work on Indian geography. At the close of the last century Major Lambton drew up a project for a general triangulation of Southern India. He commenced work by a careful triangulation of Southern India, but for several years no notice was taken of his import-

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

ant services to science. In 1817 the French institute elected him a corresponding member, and after this honors and applause followed from his own countrymen. His assistant, Captain Everest, discovered that Lacaille's meridional arc, at the Cape of Good Hope, was in error through the deflection of the plumb-line at the ends of the arc, under the influence of the attraction of the neighboring mountains, and thus became aware of the necessity of placing astronomical stations where this cause would not be active. Everest introduced great improvements into the methods of the survey, which, before Lambton's death, had been extended in its scope to embrace the whole of India, and his methods were followed until the completion of the principal triangulation. Many of the forest regions of India are most pestilential. Native troops mutinied at being taken into the Godavery basin, for fifty years the chain of triangles passing through it remained untouched, and its execution cost the life of the officer in charge. The Terai, at the base of the Nepalese Himalayas, was still more formidable, yet, owing to the refusal of the Nepalese government to permit Europeans to enter their territory, a connecting chain of triangles had to be carried along its 500 miles, necessitating the clearance of some 2000 miles of line through forest and jungle, and the construction of over 100 towers to overlook the earth's curvature. The mortality was greater than in many a famous battle. In 1843 Everest was succeeded by Waugh, who retired in 1861, and the last chain of the principal triangulation was completed in 1882.

The two longitudinal arcs first measured in India were employed by Colonel Clarke in his last investigation of the figure of the earth, and General Walker stated his belief that they are the only two arcs sufficiently accurate to be thus used. These investigations show that the equator has much less ellipticity than was formerly believed, and that the major axis is 8° 15′ west of Greenwich, instead of 15° 34′ east of it, as was previously supposed. The French meter, supposed to be a ten-millionth part of the earth's meridional quadrant, is now known to be nearly $\frac{1}{5000}$th part less than the magnitude it was intended to represent.

Mr. Hosie's Travels in China.—At the recent meeting of the British Association Mr. A. Hosie gave an account of three journeys in Southwestern China made by him since the beginning of 1882. The first was through Southern Ssu-ch'uan and Northern Kweichou to its capital, Kwei-yang-Fu, westward to Yunnan Fu, then through Northern Yunnan and along the Nan-kuang river to the Yang-tsze, where he took boat to Ch'ung-ch'ing, his starting-point. In 1883 he passed to Ch'êng tu, the capital of Ssu-ch'uan, by way of the brine and petroleum wells of Tzu-liu-ching, then through the country of the Lolos, then by Ning-yüan, in a valley famous as the habitat of the white-wax insect, to and through the mountainous Cain-du of Marco Polo, inhabited in great part by Mantzu tribes. Reaching the Chin-sha Chiang or river of golden sand, he then proceeded to Ta-li Fu and Yunnan Fu, when he descended the Yung-ning river to Lu Chou. In 1884 he went to Ho Chou, north of Ch'ung-Ch'ing, thence through a cultivated and fertile country to Chia-ting Fu, on the right bank of the Min and thence south on the eastern side of independent Lolodom, to the river of Golden Sand at the town of Man-i-ssu. Chia-ting is the great center of sericulture in Ssu-ch'uan, and the chief insect wax-producing city in the empire. A day's journey from it is the famous mount O-mei, 11,000 feet high, sacred to the worship of Buddha.

Asiatic News.—The total forest area of British India is computed at 75,270 square miles.——Colonel Prejevalsky has again failed to penetrate into Tibet over the Keria mountains in consequence of the strenuous opposition of the Chinese.——Dr. Otto Finsch has explored 1000 miles of the coast of Northern (German) New Guinea, has discovered several good harbors, and has followed a large river thirty miles into the interior. The interior is mountainous, the plains near the sea are richly covered with trees and bush and well watered, the soil is of the richest fertility, and the natives are friendly. Dr. Finsch found no trace of minerals, and regards the reported discovery of gold on the Fly river as a "schwindel."

AFRICA.—*Somaliland.*—The October issue of the Proceedings of the Royal Geographical Society, contains F. L. James's account of his journey through the Somali country to the Webbe Shebeyli. The journey was in many respects the most successful that has ever been made in that region, since the party succeeded in penetrating Ogadayn, more than half crossing the peninsula, and returning without a contest. The return was, however, compelled by the attempt of the Sultan of Barri to make his visitors assist him against his rival. The greatest danger to which the travelers were exposed, arose from Lord Granville's telegram forbidding the expedition to proceed. This arrived after their departure, but its open publication in Berbera caused the Somali to believe that the travelers were in disfavor with the British government. Firearms were new to the Somali of Ogadayn, and the rifles insured respect. Most of the country appears to be a stony desert, but settlements are abundant on the Webbe, which does not reach the ocean, but loses itself a few miles from the coast. In Ogadayn there is a subject people called Adone, with strongly-marked negro features. About 150 species of plants, chiefly herbs and under-shrubs, were brought back, including a specimen of an apocynaceous plant which affords an arrow-poison. Sixty-one species of birds, seven of which are new, and forty-six kinds of Lepidoptera, seventeen of them new, were also brought back. The genealogy of the Somali tribes is given. They are all said to be descended from two brothers, Darode and Tsak, Ogadayn was a son of the former.

The Lake Mœris.—Mr. Cope Whitehouse described to the British Association the basin of the Reian Mœris in Egypt, and spoke of the possibility of the restoration of this historic lake. South of the Fayoum exists a depression of several hundred square miles, not less than 150 feet below the Mediterranean, and in the parts visited by the writer, 175 to 180 feet deep. The area is irregular, curving like a horn from near Behnessa to the ridge which separates it from the Fayoum. Ruins exist in its southern part. The level of the ruins proved that the ancient station of Ptolemais might have been as shown in the text and maps of Ptolemy, on a horn-shaped lake about thirty-five miles long and fifteen wide.

The Kassai Tributary of the Congo.—Lieut. Wissman speaks enthusiastically of the Kassai as a magnificent fluvial artery, frequently of enormous breadth, leading into the heart of the new Congo State. The country on its banks is of wonderful fertility. During the forty-two days occupied in the voyage from Luluaburg to Kwamouth, the health of the expedition was excellent, the five whites and 200 negroes all arriving in good health at Leopoldville on July 16th. The Sankaru and Lubilash are one river, which turns westward, and joins the Kassai. The Kassai receives the great Koango, and enters the main river by the Kwamouth, after receiving the waters of Lake Leopold.

African News.—The country between Blantyre and Quillimane has been described by Mr. H. E. O'Neill and Mr. D. J. Rankin in the Proceedings of the Royal Geographical Society. The Portuguese authority has recently been considerably extended up the Shiré towards Lake Nyassa.——The Kassai, the great southern tributary of the Congo, instead of entering the main stream north of the equator, joins it in 3° 13′ S. lat.——Mr. D. D. Veth, leader of a Dutch expedition into Portuguese West Africa, died on May 10th, between Benguela and Humpata.

GEOLOGY AND PALÆONTOLOGY.

INTERNAL CHEMICAL AND MECHANICAL EROSION A FACTOR IN CONTINENT AND MOUNTAIN BUILDING.—As soon as it is affirmed that since early Laurentian times the great continental folds and depressions have not changed places, so soon it becomes necessary to explain how these great ridges and troughs have persisted, as such, in spite of the amount of erosion and sedimentation which are known to have taken place and which we know to be still going on at no small rate. Either the pre-Laurentian inequalities of surface were vastly greater than they are now, or else, during all the ages the ocean beds have been constantly receiving sediment and sinking, while the continents have been as constantly eroded and rising. But this latter hypothesis implies that there has been and is a continuous circulation of the material of the solid land from the continents to the ocean, and from the ocean back to the continents again, a circulation, in some degree, like what is taking place in the ocean between the equator and the poles, that is, a bodily transfer of superficial materials one way and a slow general under-creep of materials back.

But how is such a system possible and how can it be maintained? If we assume, as appears to be required by both physical principles and geological facts, that the earth's surface is only slightly out of equilibrium and is constantly tending toward that state, then any transfer of material from the continents to the ocean would cause a subsidence of the ocean beds which, in turn, must necessitate a setting of the deeper earth materials from beneath the ocean beds toward the continents causing them to rise. This circulation appears to be entirely possible and even probable, if not almost certain, and this too, while granting that the earth is essentially solid throughout and as rigid as glass. By this is meant, of course, as rigid as glass would be under the internal earth pressure.

It appears to me, geologists have no occasion for dissenting from the views expressed by leading physicists in regard to the rigidity of the earth for, as I see it, there may be all the rigidity which physicists have claimed and yet all the mobility geological facts can demand. When cold metals are subjected to artificial pressure, causing their molecules to flow into new positions so that the form of the mass is greatly changed, it is not to be supposed that these metals while under such pressure are to be regarded as true liquids, in any sense obedient to all the laws of fluids, nor could any mere pressure, however great, convert them into true liquids. I think it will not be maintained, even by those who believe "pressure itself would reduce the interior of the earth to a fluid condition," that this fluid is such to the extent of permitting bodies moving freely through it as fish move through the sea; nor would they maintain that this interior fluid would remain such with the pressure removed. It could hardly be maintained either, that such a fluid would possess the degree of elasticity characteristic of true fluids, but unless these are insisted upon by geologists, physicists have all the rigidity they have claimed.

Even if it is admitted that such a circulation is possible when conditions are once favorable, unless there is some disturbing agent continually working to destroy the equilibrium which the circulation tends to establish, eventually the earth's surface must have existing differences of level greatly reduced. There appears no escape from the conclusion that the density of the earth increases as its center is approached. This being the case, a continual denudation from certain regions and constant sedimentation in others must, in due time, whatever may have been the original distribution of density near the earth's surface, remove all materials of low density from the continents and place them over the sea bottom, while the elevation of the denuded region would bring denser materials to the surface, thus tending to restore equilibrium with the two surfaces more nearly on the same level, unless there is some agent operating to reduce the average specific gravity of the continents.

If the earth does increase in density toward the center, this may be due: first, to a difference of chemical composition; or second, to increasing pressure; or third, to these two conditions in combination. With either the first or third conditions existing, and continued denudation with no counter agent, a leveling up would inevitably result. With the second condition existing, unloading in one place and loading in another of equal area, would permit of expansion in the continental mass and cause a compression of strata under the oceans, and might maintain the differences of level already established; but this view being very improbable, it remains to search for some cause which may reduce the specific gravity of the continents, and an adequate one, it seems to me, may be found in internal chemical and mechanical erosion.

Taking Mr. T. M. Read's estimate of chemical erosion (Am. Jour. Sci., April, 1885), at 100 tons per square mile annually on the average the world over, as a fair estimate of the work done by the waters which come to the surface before emptying into the ocean, it is plain that a vast work must be done in reducing the average specific gravity of the continents, unless it is maintained that the small cavities produced are closed by compression as fast as formed. This certainly is not the case in the superficial strata, nor can it be the case in the deeper strata where the cavities produced by solution remain filled with water.

Data are altogether too meager to allow of a quantitative treatment of the question. We do not know, for example, what proportion of the matter carried in solution to the sea by rivers annually is obtained through purely superficial action. Neither do we know what proportion of the water falling upon the continents enters the ocean below ocean level. It is reasonable to suppose that this amount is not small, and that the water entering the sea below ocean level carries a higher per cent of solids than the average river water. Now that our Government scientific work is being consolidated, it would seem eminently fitting that these fundamental questions should occupy the joint attention of the U. S. Geological Servey and the Signal Service, and they are possibly already under consideration.

This internal erosion, by excavating small cavities in the body of the continents, would lighten them without in the same degree lowering their surfaces, and existing differences of level would be longer, if not permanently, maintained, because in case the denser strata were to be thrust up into the heart of the continents, into the region of aqueous action, they would be attacked by the water and their average specific gravity lowered. Now in case superficial erosion were to exceed internal erosion, the result would be a lowering of the continents; but any lowering of the continents would reduce the rate of mechanical erosion much faster than it would the chemical, because very feeble springs and the mere capillary updraught of saturated water, would remove the solid ingredients of the continents and place them in position to be drawn off to the sea by currents too feeble to bear much solid material in suspension. The specific gravity of the continents would, by this means, be continually lowered, and the oceanic areas as continuously loaded, and, for this reason, we might expect the continents and oceanic basins to persist. Again, even if we suppose the same degree of porosity to exist in the sedimentary beds under the ocean as exists in those of the continents and the materials of the two to have the same specific gravity, the same number of feet of sediment under the ocean would be heavier, volume for volume, than the land because, if for no other reason, the beds would be, in all probability, more fully saturated with water. Now Professor Ferrel has shown that the attraction of continental plateaus must be neglected in reducing both pendulum and barometric observations to sea level, and therefore they do not represent so much material added between a given station and the earth's center; that is, these earth masses, although possessing longer radii, are no heavier than equal sections in the ocean areas.

Assuming that the continents and ocean beds, with their superincumbent water, are essentially in equilibrium, and taking the average depth of the oceans as 15,000 feet and the average height of continents, above sea level, as 1000 feet, we could obtain a tolerably accurate estimate of the average specific gravity of the continents if we knew the average density of the rocks below the sea bottom, knowing, as we do, the specific gravity of 15,000 feet of superimposed matter. The specific gravity of the earth 400 miles below the surface is estimated at 4.0478 (U. S. Coast and Geodetic Survey, 1879), and our heaviest known rocks scarcely run above 3. From these considerations, and from what we know of the specific gravity of sedimentary rocks, we should not expect the sedimentary beds of the sea bottom to have a specific gravity much above 2.5. Assuming an average of 2.5 for the first 5000 feet below sea bottom and of 2.95 for the next 10,000 feet, then the average specific gravity of the continental mass required to exactly balance this would be 1.851, assuming, of course, that a surface of uniform density under both oceans and continents is reached at a depth of 30,000 feet below the sea level. Now considering the specific gravity to increase below 15,000 feet below sea bottom at the rate of .05 for every 10,000 feet downward, it would then be necessary to go to a depth of about thirteen miles below sea level to obtain an average density sufficiently large to balance continental masses having an average specific gravity of 2.5. If the specific gravity does not increase downward as rapidly as the rate assumed, as we may infer from Mr. Pierce's table (U. S. Coast and Geodetic Survey, 1879, p. 200), then a still greater depth would be required to secure equilibrium. From these considerations it would appear that the superficial continental strata must have an average specific gravity much below 2.5 and, in order that this may be so, that much material must have been removed from within the mass.—*F. H. King, River Falls, Wis., May 12, 1885.*

GEOLOGICAL SURVEY OF BELGIUM.—In 1878 a commission was appointed to undertake a more exhaustive investigation of the geology of Belgium than that embodied in the map of Dumont. The topographical map serving as a basis consists of 369 sheets. Each important group of formations is entrusted to one or more specialists, who are each furnished with two assistants, and trace the system completely across the country. Every actual outcrop of rock is marked on the map, and where the rock is fossiliferous the fossils are noted. Special attention is given to soils and subsoils, and care taken to express on the map the agricultural character of the ground. It is believed that one-third of the entire work of the survey is now completed. By a novel system of broad washes of subdued tints, M. Dupont, the head of the survey and Director of the Royal Museum at Brussels, contrives to show the surface deposits, as well as the formations below, which are shown in deeper tints; while shaded lines of the proper color mark the margins of the stage. Professor Archibald Geikie expresses in *Nature* his conviction of the success of the new system of cartography.

THE BED OF THE OCEAN.—The Tuesday evening discourse during the late meeting of the British Association was delivered by Mr. J. Murray, F.R.S., of the *Challenger* expedition, who took for his subject the "Bed of the ocean, and some results of the expedition." In commencing his lecture, Mr. Murray traced the development of geographical knowledge from the crude conception of the ancients down to the extended knowledge of the nineteenth century. It was not easy, he said, to estimate the relative importance of the events of one's own time, yet, in all probability, the historians of the reign of Victoria would point to the recent discoveries in the great oceans as the most important events of the century with respect to the acquisition of natural knowledge—as among the most brilliant conquests of man in his struggle with nature; and doubtless they would be able to trace the effects of these discoveries on the literature and on the philosophic conceptions of our age. The last of the great outlines showing the surface features of our globe had been boldly sketched; the foundations of a more complete and scientific physiography of the earth's surface had been firmly laid down. The lecturer then briefly described the chief surface features of the globe, the action of wind and water and ocean currents; referred to the temperature of the surface of the sea, and explained that the most important, as well as the most direct, effect of the unequal distribution of temperature over the surfaces of the oceans and continents was an unequal distribution of atmospheric pressure, varying more or less with season. He then proceeded: The advances during recent years in the knowledge of one form of life inhabiting the floor of the ocean surpassed those in any other department of oceanic investigation. Thousands of new organisms had been discovered in all seas and at all depths in the ocean, and either had been or were now being described by specialists in all quarters of the world. There did not seem to be any part of the ocean bed so deep, so dark, so still, or where the pressure was so great as to have effectually raised a barrier to the invasion of life in some of its many forms. Even in the greater depths all the great divisions of the animal kingdom were represented. As they descended into the deeper waters, and proceeded further seaward from the borders of the continents, species and the number of individuals became fewer and fewer, though they often presented archaic or embryonic characters, till a minimum was reached in the greatest depths furthest from continental land. Distance from continental land was, indeed, a much more important factor in the distribution of deep-sea animals than actual depth. If they neglected the Protozoa and compared the results of twelve of the *Challenger's* trawlings and dredgings in the central line of the Pacific, in depths greater than 2000 fathoms, on globigerina ooze, radiolarian ooze, and red clay, with twelve trawlings and dredgings taken under similar conditions and depths, but on the blue and green muds within 200 miles of the continents, they found that the central Pacific stations yielded ninety-two specimens of animals belonging to fifty-two species, all—with two doubtful exceptions—new to science, and among them thirteen new genera. On the other hand, the stations near the continents gave over 1000 specimens, belonging to 211 species, of which 145 were new species and sixty-six belonged to species previously known from shallower water. Although no new types of structure had been discovered in organisms from the deep sea, the peculiar modifications which animals had undergone to accommodate themselves to abysmal conditions were sufficiently interesting and remarkable. The eyes of some fish and crustaceans had become atrophied or had disappeared altogether, while in others they had become of exceedingly large size, or been so modified as to be scarcely recognizable as eyes. Fins and antennæ had become extraordinarily elongated, and at times appeared to simulate the alcyonarians of the deep sea. The higher Crustacea and some families of fish had very few and very large eggs in the deep-sea species, while their shallow-water representatives had a very large number of very small eggs; showing apparently that the deep-sea species had relatively few enemies. Many deep-sea animals emitted, and some had special organs for the emission of phosphorescent light, which appeared to play a large *rôle* in the economy of deep-sea life. One of the most striking facts with respect to deep-sea animals was their very wide distribution, the same species being found in all the great ocean basins. After referring to examinations of coral atolls and barren reefs, Mr. Murray said the results of many lines of investigation seemed to show that in the abysmal regions they had the most permanent areas of the earth's surface, and he was a bold man who still argued that in Tertiary times there was a large area of continental land in the Pacific, that there was once a Lemuria in the Indian ocean, or a continental Atlantis in the Atlantic. It mattered little whether the opinions which he had given as to the bearing of some of the researches be correct or not. The great point was that there had been a vast addition to human knowledge, and it must be a matter of satisfaction that our own country had taken so large a share in these important investigations as to call forth the admiration of scientific men of all countries. In the matter of deep-sea investigation, neglecting mere details, we could say that successive governments during the past twenty years had, either from design or by accident, undertaken a work in the highest interests of the race, had carried it on in no mean or narrow spirit, and were likely to carry it to a termination in a manner worthy of a great, free and prosperous people.

GEOLOGICAL NEWS.—*General.*—The third International Congress of Geologists has just been held in Berlin, 255 members being present, the majority Germans. Italy sent eighteen, Austria sixteen, Great Britain eleven, France ten, and the United States nine representatives. The most important work of the congress is the preparation of a geological map of Europe. It is expected that next year proofs in color of many of the sheets will be ready. The unification of geological nomenclature does not appear likely to be realized, but the congress has agreed that the Archæan rocks shall be divided into sections according to their petrographical characters, without expressing any opinion as to their relative age.

Jurassic.—At the recent meeting of the French Association, M. Cotteau stated that the Jurassic strata of France have furnished 125 species of Echini, belonging to fifty genera, two only of which, Cidaris and Stomechinus, subsist at the present day. The shallow seas of the Jurassic epoch, full of islands and coral reefs were favorable to the development of Echini.——M. Loriol has published, in the *Paléo tologie francaise*, descriptions of 209 crinoids found in France. Of these eighty-nine were new to science;

while the Echini were most abundant in the Bajocian stage of the Jurassic, the crinoids attained their maximum in the Oxfordian. After the Sequanian they suddenly diminish, and only one species occurs in the Portlandian.

Quaternary.—At Ternefine near Maseara (Algeria) teeth of two species of Elephas (*E. atlanticus* and *E. melitensis*) have been found, also *Rhinocerus mauritanicus*, a hippopotamus and *Camelus thomasi.* The last is of about the size of the dromedary, but differs in the shape of the palate and jugal bones. With these were found a horse rather larger than the zebra, some antelopes, an ox, and a single bone of a swine. Roughly-shaped hatchets of limestone or coarse sandstone show the presence of man, but no remains of the domestic dog and no bones marked by the teeth of Carnivores were found. The presence of a large number of the cotyloid cavities of the pelvis of the elephant seem to indicate that they were used as utensils, and the numerous canines and incisors of the hippopotamus found were probably employed as weapons.

MINERALOGY AND PETROGRAPHY.[1]

AMERICAN MINERALS.—*Quartz.*—Vom Rath describes[2] quite a number of complicated forms on the quartz crystals from Alexander and Burke counties, N. C. The former have already been mentioned in these notes.[3] Among the rare forms on the latter are $-\frac{11}{18}R\frac{11}{7}$, P_2 and a rough face to which the symbol oP may be referred.

Stephanite.—In the same article a stephanite crystal from Mexico, containing the new form $\frac{11}{8}\breve{P}\frac{11}{8}$ is described.

Alaskaite of König,[4] has been reëxamined by Th. Liweh, of Strassburg, who declares it to be tetrahedrite. He found it to crystallize in the hemihedral division of the regular system.

In the November number of the NATURALIST, fayalite was mentioned as having been found by Mr. J. P. Iddings in the lithophyses of the obsidian and rhyolite from the Yellowstone Park. About the same time C. A. Tenne,[5] of Berlin, found the same small black crystals in the lithophyses of obsidians from the Cerro de las Navajas, Mexico. They were measured and pronounced to be the same mineral which G. Rose, as early as 1827,[6] had declared to be olivine.

[1] Edited by W. S. BAYLEY, Johns Hopkins Univ., Baltimore, Md.

[2] Mineralogische Mittheilungen. Zeitschrift für Krystallographie, x, pp. 156 and 475.

[3] May, 1885.

[4] Ueber die alaskaite, ein neues Glied aus der Reihe der wismuthsulfosalze. Zeitschrift für Krystallographie, VI, p. 42.

[5] Zeitschrift der deutschen geol. Gesellschaft, 1885, p. 613.

[6] Annalen der Physik. u. Chemie, 1827, Bd. x, pp. 323–332.

Turquoise pseudomorphs after apatite have been discovered[1] in several localities in California with the original forms so well preserved as to leave no doubt as to the character of the mineral after which they are pseudomorphed. The angles between the ∞P faces gave, on the reflexion goniometer, a mean value of $59° 56'$, that between $0P$ and ∞P measured $89° 39'$, and those between $0P$ and P $40° 35\frac{3}{4}'$. (Kokscharon found on apatite from Tokovaia $0P \wedge P = 40° 18'–40° 47'$.) Professor H. Bücking examined thin sections of the specimens and found the substance to consist of an aggregate of small spherulites composed of fibers radially arranged.

Two *pure iron micas* from Branchville, Conn., have been added to the mica group by Rammelsberg.[2] One of a light color gave, on analysis:

SiO_2	Al_2O_3	Fe_2O_3	FeO	K_2O	Na_2O	Li_2O	H_2O	Fl
44.19	32.69	4.75	3.90	8.00	.59	.21	.3.85	.93

A dark-brown variety gave:

SiO_2	Al_2O_3	Fe_2O_3	FeO	K_2O	Na_2O	Li_2O	H_2O	Fl	TiO_2
39.94	23.43	7.65	11.87	9.64	1.13	1.18	2.64	2.43	.20

The composition of the first corresponds to $\left\{\begin{matrix} 6\,R_4'\,SiO_4 \\ Fe_2\,SiO_4 \\ 7\,\bar{R}_2\,Si_3O_{12} \end{matrix}\right\}$; of the second to $\left\{\begin{matrix} 2\,R_4'\,SiO_4 \\ Fe_2\,SiO_4 \\ 2\,\bar{R}_2\,Si_3O_{12} \end{matrix}\right\}$. In neither case was any Mg detected. Their optical properties were not investigated.

Microlite.—C. Hintze[3] has shown by optical methods that this mineral, first described by Dunnington[4] from Amelia county, Va., crystallizes in the regular system.

In a paper read before the American Philosophical Society, F. A. Genth[5] gives the results of the analyses of a number of minerals belonging to the sulpho-salts and allied groups. The mineral joséite, concerning whose composition there has been considerable doubt, yielded the author:

Te	Se	S	Bi
14.67 per cent	1.46 per cent	2.84 per cent	81.23 per cent

This composition, Genth thinks, cannot be expressed by a rational formula unless we suppose the mineral to be a bismuth sulphide in which the sulphur is replaced in part by tellurium, selenium and bismuth, giving the general formula both for joséite and the closely related tetradymite $Bi_2\,(Te\,Se\,S\,Bi)_3$. An argento-bis-

[1] Kallait pseudomorph nach apatite aus California, G. E. Moore and V. von Zepharovich. Zeitschrift für Krystallographie X, p. 240.

[2] Neues Jahrb. für Min., etc., 1885, II, p. 225.

[3] Zeitschrift für Krystallographie, X, p. 86.

[4] *Amer. Chem. Jour.*, 3, p. 130, May, 1881.

[5] Contributions from the laboratory of the Univ. of Pennsylvania. No. XXIV. Contributions to mineralogy, read Oct. 2, 1885.

muthite, from Lake City, Col., gave results corresponding to $(Ag_2 Pb) S, Bi_2 S_3$. Cosalite is a sulpho-bismuthite of the formula $2 (Pb Ag_2) S, Bi_2 S_3$ from Cosala, Mexico. In the Gladiator mine, Ouray county, Col., a compact mineral occurs in small irregular masses. An analysis shows it to be cosalite with part of the silver replaced by Cu, having the formula $2 (Pb Ag_2 Cu_2) S, Bi_2 S_3$. Schirmerite, beegerite, tetrahedrite, sylvanite and polybasite from Colorado, and arsenopyrite and scorodite from Alabama are the other sulphur salts examined. Ilmenite from Carter's mine, N. C., topaz from Stoneham, Me., muscovite pseudomorphs after nepheline from Wakefield, Conn., stilpnomelane pseudomorphs after "an unknown tabular mineral," from Sterling mine, near Antwerp, N. Y., and several alteration products of the magnesian limestone of Berks county, Pa., are also described and the results of their analyses given.

MICROCHEMICAL REACTIONS.—It is often possible by means of a few simple chemical tests to determine the character of a mineral under the microscope without the trouble of separating and analyzing it. The methods in most general use for this purpose are those of Streng[1] for the detection of apatite and nepheline, of Knop[2] for the minerals of the Hauyne group, of Boricky[3] for the feldspars and of Behrens[4] for the characteristic elements of many other minerals. These and a great many others have been described at length in the various mineralogical magazines, but have not, until very lately, been collected and put in shape for ready use. Dr. Haushofer, of Munich, has recently brought together all those methods which have stood the test of experience, and to these has added others of his own. The result is a compact little book[5] containing minute directions for the detection of fifty elements by means of simple tests, most of which may be applied to the rock section or mineral particle on the stage of the microscope. The illustrations are good and the directions for working clearly given.

CRYSTALLOGRAPHIC NEWS.— E. Rethwisch[6] has made a very thorough study of pyrargyrite and proustite from an historical,

[1] A. Streng. Ueber die mikroskopische Unterscheidung von nepheline and apatite. Tschermak's Min. und Pet. Mitth., 1876, p. 167.

[2] A. Knop. Ueber eine mikrochemische reaction auf die Glieder der Hauynfamilie. Neues Jahrb. der Min., etc., 1875, p. 74.

[3] E. Boricky. Elemente einer neuen chemisch mikroskopischen Mineral- und Gesteins-analyse. Archiv. d. naturw. Landes durchforsch. Böhmens. III Bd., V Abth., Prag, 1877, and Neues Jahrb. f. Min., etc., 1879, p. 564.

[4] Th. H. Behrens. Mikrochemische Methoden zur Mineral-analyse. Verslagen en Mededeelingen der K. Akad. v. Wetenschappen. Amsterdam, 1881. Afdeeling Natuurkunde, 2 Reeks, XVII Deel., pp. 27-73.

[5] Mikroskopische Reactionen. Eine Anleitung zur Erkennung Verschiedener Elemente und Verbindungen unter dem Mikroskop. Vieweg und Sohn, 1885. 162 pp., 137 illus.

[6] Neues Jahrb. für Min., etc. Beilage Band IV, p. 40.

chemical and crystallographic standpoint. His paper is particularly interesting as a résumé of our knowledge in regard to these two minerals.——In the same way F. Sansoni proposes to study calcite. He begins his work with an exhaustive paper of fifty-six pages on the crystals from Andreasburg.[1] He divides these into eight groups, according to their development, and then studies each group separately. Tables giving the frequency with which the 131 forms actually observed occur, and the combinations in which they are found, make up a considerable part of the article.

Miscellaneous.—A chemical examination of nocerite[2] from Samo-Nocera leads E. Fischer to consider it a mixed fluoride and oxide with the composition $2\,(Ca\,Mg)\,Fl_2 + (Ca\,Mg)\,O$.——In an article on the Thüringian minerals, Luedecke[3] describes crystals of orthite, from near Schmiedefeld, with the two new planes $5\,P\bar{\infty}$ and $\infty P\bar{10}$, others from a granitite near Brotterode with $\frac{7}{8}\,P\bar{\infty}$, and tiny brown anatase crystals on small quartz crystals in the lithophyses of a quartz porphyry from Brand, Thüringer Wald.

BOTANY.[4]

The Asa Gray Vase.—During the meeting of the American Association for the Advancement of Science, at Ann Arbor, in August last, the presence of so many botanists, and especially their frequent club meetings, suggested to the editors of the *Botanical Gazette* the possibility of some concerted action on the part of the botanists of the country to commemorate Dr. Asa Gray's seventy-fifth birthday anniversary. After some informal consultation, the matter was left in the hands of the originators to be managed as they thought best. Accordingly, notices were sent to as many American botanists as it was possible to reach in the short time at the disposal of the committee. The responses were most gratifying, and enabled the committee to select a design of a vase by L. E. Jenks, of Boston. The vase is solid silver, eleven inches in height, and stands upon a silver-hooped ebony pedestal. The ornamentation is very properly entirely botanical, and consists of plants in some way associated with Dr. Gray's work, or which are distinctively American. In the center of one side is *Grayia polygaloides*, on the other *Shortia galacifolia*. The following species are represented in the surrounding figures, viz: *Adlumia cirrhosa*, *Rudbeckia speciosa*, *Centaurea americana*, *Aquilegia canadensis*, *Aster bigelovii*, *Solidago serotina*, *Notholæna grayi*, *Lilium grayi*, *Dionæa muscipula*, *Jeffersonia diphylla*, *Mitchella repens*, *Epigæa repens*. The beauty of design and finish, as

[1] Zeitschrift für Krystallographie, x, p. 545.
[2] Zeitschrift für Krystallographie, x, p. 271.
[3] Ib., x, p. 187.
[4] Edited by Professor Charles E. Bessey, Lincoln, Nebraska.

well as the botanical accuracy of the work, have been much admired. Upon the hoop of the pedestal the following legend is engraved:

1810—November eighteenth—1885.
ASA GRAY,
In token of the universal esteem of American botanists.

The vase, accompanicd with the cards of one hundred and eighty botanists, was presented without formality on Wednesday morning, the 18th of November.

It is a very pleasant duty to record in the NATURALIST the consummation of such a fitting plan of showing the esteem in which the name of Asa Gray is held by the botanists of America. That the days of the genial doctor among us may be prolonged for many years is the fervent prayer of every botanist.

CATALOGUE OF THE PLANTS OF NORTH AMERICA.—Every botanist who has charge of a considerable collection of plants has felt the need of a convenient check-list of North American plants. The old Gray Catalogue, which was followed by the Mann Catalogue, both confined to the plants included in Gray's Manual, and later, the more extended list compiled by A. H. Curtiss, served a good purpose. These, however, included a comparatively small part of the species of the whole continent, and the botanist who added Western species to his collection was left without the means for noting his accessions. This want is now supplied (in part, at least) by the Catalogue of the Phænogamous and Vascular Cryptogamous plants of North America (north of Mexico) compiled by J. H. Oyster, of Paola, Kansas. It contains entries of 9867 species. The arrangement of Choripetalæ and Gamopetalæ conforms very nearly with that of Bentham and Hooker's Genera Plantarum. For some unexplained reason the arrangement of Apetalæ and the Monocotyledons is not that of the Genera Plantarum, an unfortunate feature which might easily have been avoided. The species of each genus are arranged alphabetically, as is proper in a check-list. The proof-reading has been carelessly done, and the printing is not of the best; yet, with all its faults, the pamphlet is worth the price charged for it ($1.00), and will serve a good purpose.

THE DE CANDOLLE PRIZE.—The Physical and Natural History Society of Geneva offers a prize of five hundred francs for the best monograph of a genus or family of plants. The manuscript may be written in Latin, French, German, English or Italian, and should be sent to M. le President de la Société de Physique et d'Histoire Naturelle de Genève, a l'Athenée, Genève, Switzerland. —*Gardner's Chronicle.*

THE DRYING OF WHEAT.—Experiments were made in 1884 at the New York Agricultural Experiment Station upon the loss of water by wheat in drying. In the first case Clawson wheat, harvested July 16 and threshed July 18, contained 27.02 per cent of water, of which there were lost by evaporation the following percentages, viz:

July 27	loss 13.80 per cent.	Sept. 14	loss 20.33 per cent.
Aug. 3	" 17.33 " "	" 21	" 20.39 " "
" 10	" 18.59 " "	" 28	" 19.54 " "
" 17	" 19.58 " "	Oct. 5	" 18.97 " "
" 24	" 20.62 " "	" 12	" 19.48 " "
" 31	" 19.97 " "	Nov. 22	" 24.06 " "

In the second case samples were taken from the bin on September 4, with the following results, viz:

Sept. 14	loss 2.77 per cent.	Oct. 5	loss 1.57 per cent.
" 21	" 3.12 " "	" 12	" 2.18 " "
" 28	" 2.15 " "	Nov. 22	" 8.12 " "

In both cases the samples were exposed to the natural air of the laboratory until October 12, after that date, to November 22, the air was warmed by steam pipes.

The amount of water in wheat in the bin taken at different dates, from the interior of a mass of several hundred bushels, was as follows, viz:

September	22	11.96 per cent of water.
October	13	16.57 " " "
"	23	14.62 " " "
November	1	14.17 " " "
"	12	14.87 " " "

THE STUDY OF PLANTS IN WINTER.—The old-fashioned textbooks tell us to begin the study of plants in the spring, and the custom still in most colleges is to confine the study to the spring and early autumn months. Winter usually stops all work except in the laboratories when "pickled" specimens are dried and examined microscopically. Perhaps in a few cases the green-house may supply unseasonable specimens for class or laboratory study; but this is not the study of plants in winter that we refer to. All our perennials have winter states which are full of interest to the student. The writer of this note has taken classes of young people, who knew nothing of botany, and set them at work in midwinter studying the out-of-door vegetation, with nothing but their eyes, pocket-knives, pencils and note-books in the way of apparatus and helps. The structure, position and functions of buds, the structure of twigs and branches, including wood, bark and pith, the structure of the fruits and seeds, of various trees and shrubs, were taken up in succession, with constantly increasing interest. No text-book was used, the pupil depending upon his own resources entirely. By the time that spring came with its bursting buds, its leaves and its flowers, these trained young eyes were eager for their study.

THE BOTANICAL VALUE OF AGRICULTURAL EXPERIMENTS.—That many of the so-called agricultural experiments should have a high botanical value is evident to every scientific man, but it is a melancholy fact, which does not speak well for the accuracy of the experimenters, that very little of their work has been of use in scientific botany. In the experiments recorded in the third annual report of the New York Agricultural Experiment Station, we have a notable exception to the rule. Many of the results obtained have a high value to the physiological and pathological botanist. Thus we find such topics as the following, viz: The hygroscopic properties of grains; Hybrid barley; Germinations of commercial seeds; The cross-fertilization of maize; A classification of maize, with a description of the species and varieties (with plates); A classification of the agricultural species of garden peas; The size and distribution of roots of various plants determined by washing away the soil; A classification of barley and oats; Report of the botanist upon diseases of the pear, apple, quince, peach, tomato, oats, clematis and Canada thistle. Topics like these, treated as these are, command the respect of scientific men. We hope to see the time when such will be the rule, and not as now the exception.

We hold that every agricultural experiment which has to do with plants must be sufficiently accurate to commend itself to the scientific man, in order that it may be of any permanent value to agriculture. Such an experiment which has no botanical value cannot have a permanent agricultural value. The demands of scientific botany are in no wise more exacting than those of scientific agriculture.

FERTILIZATION OF TEUCRIUM CANADENSE.—Of interest to American botanists is the proterandry of the American germander, simulating that of *T. scorodonia* of Europe. The corolla here is not bilabiate as usual in this family, but the tube is split open above as far as the calyx and the five lobes are arranged on one —lower—lip. In the bud the lowest or middle lobe turns up over the stamens and style, serving as a protection to them. This lobe is embraced by the two lobes on either side, and these in turn by the two upper lobes, which usually form the upper lip in the Labiatæ. In their first state, as in almost all flowers of this family, the stamens are curved forwards so as to come into more ready contact with the body of the entering insect, in this case usually a bee. The stigma is bent forwards like the stamens, but the stigma lobes having not yet opened, cannot be fertilized. Later the stamens bend far backwards, and since there is no upper lip to check this motion they actually recurve at times. The style in the meantime retains its position or takes a slightly higher position, while its stigma lobes open. The stamens themselves may be short and these are usually of almost equal length, or one or more of them may continue growth and even equal the style in length. There is no regularity, however, in their unequal development, but if the visits of bees should become less frequent, this variation would offer a means of self-fertilization, and would soon become fixed in all individuals of the species. The proterandry in this species is not perfect. The stigmas sometimes mature, I might almost say, precociously, and the stamens in turn often contain good pollen when the stigma lobes open. Again, the visits of bees seem to be less frequent in this part of the country than is usual with cross-fertilized Labiatæ, so I suspect that even the casual irregular growth of the stamens, is in some way correllated with this fact.—*Aug. F. Foerste, Granville, Ohio.*

Specimens of Cuscuta wanted.—Dried or alcoholic specimens of various species of Cuscuta are wanted by the subscriber. Any one having good specimens in flower or fruit for sale or exchange will confer a favor by communicating with Charles E. Bessey, Lincoln, Neb.

Botanical News.—Among the topics discussed at the International Congress of Botany and Horticulture, held at Antwerp (Belgium), August 1 to 10, were the following, viz: The rôle of the laboratory in modern science; Instruction in cryptogamic botany; Instruction in vegetable pathology; On the monographing of large genera; The rôle and organization of botanical laboratories; Labeling in botanic gardens, public parks, private gardens and conservatories; The progress of botany (mainly in the schools) since the Congress of 1878; Instruction in vegetable physiology. The papers are published in a thick pamphlet of over 400 pages.——The September Journal of the Linnean Society contains: Supplementary notes on Restiaceæ, by Dr. M. T. Masters; Observations on continuity of protoplasm, by S. Le M. Moore; On Rosanoff's crystals in the endosperm-cells of *Manihot glaziovii*, by S. Le M. Moore; On venation and the methods of development of foliage as protection against radiation, by Geo. Henslow.——E. A. Rau contributes a short list of Kansas mosses to the fourth bulletin of the Washburn College Laboratory of Natural History.——Bertrand continues his paper on Phylloglossum in late numbers of *Archives Botaniques du Nord de la France.*——The thirty-eighth report of the New York State Museum of Natural History appears much earlier than usual, greatly to its advantage and usefulness. The report of the botanist contains descriptions of many species of fungi. The New York species of Lactarius and Pluteus are arranged and described. Every botanist will welcome the early appearance of this report. May the vexatious delays of former years not occur again.——Limpricht's Laubmoose (mosses), which will constitute Vol. IV of the new edition of Rabenhorst's Kryptogamenflora, is announced by the publisher, Ed. Kummer, of Leipsig.——Dr. Havard's report on the flora of Western and Southern Texas, in the Proceedings of the U. S. National Museum, is a valuable contribution to our knowledge of the flora of the Southwest.——In a twenty-four page pamphlet, reprinted from Studies in the Biological Laboratory of the Johns Hopkins University, Dr. William Trelease records his observations on several Zoöglœæ and related forms. The following new species are described and figured, viz: *Bacterium candidum*, *B. aurantiacum*, *B. luteum*, *B. chlorinum*, *B. incarnatum*. A valuable feature of the work recorded is its biological character. One lays down the pamphlet with the feeling that much work can be done upon the basis of Dr. Trelease's observations. This record is an incentive to further study.——Dr. Trelease's inaugural address, delivered upon his accession to the directorship of the Henry Shaw School of Botany, in St. Louis, November 6, is an admirable presentation of the claims of botany to a place in general education.——The January *Botanical Gazette* will contain a portrait and biographical sketch of Dr. Asa Gray, together with some of the poems, congratulatory addresses, etc., which were sent on his birthday, November 18, 1885.

ENTOMOLOGY.

Recent Discovery of Carboniferous Insects.—A rich deposit of Carboniferous insects has been discovered at Commentry, in the department of Allier, France, and has been worked up by C. Brongniart, whose work, however, has not yet been received. From a notice of his paper in the *Entomologische Nachrichten* for November last, we learn that over 1300 specimens of insect remains, not wings alone but also the bodies, have been preserved to science.

While an exclusive study of the shape and venation of the wings must necessarily have led to many errors, the discoveries at Commentry show that insects which are regarded as among the most ancient are still surprisingly like those of the present time, and only differ in comparatively unimportant respects.

In the oldest strata, the Silurian, has been found but a single winged insect, the still very problematical *Palæoblattina douvillei* Brong.; in the Devonian only the six species of insects, as to whose relations excellent naturalists, such as S. H. Scudder and H. Hagen, have very different views, and relative to which discussion has not yet closed. Before the present discovery only 120 specimens of Palæozoic insects were known.

From the Carboniferous formation of Commentry Brongniart has obtained over 1300 examples. Among them occurs the first fossil Thysanuran, represented by forty-five specimens. It differs from existing forms only by having a single caudal filament, and exclusive of this is 15 to 22$^{mm.}$ long, and is generally similar to Machilis; it is named *Dasyleptus lucasi*. Numerous representatives of our recent Acridians are brought together under the name of Palæacridiodea, and divided into three groups with seven, mostly new, genera.

The types so discovered belong to the three orders of Orthoptera, Neuroptera, and Hemiptera, also to the Heterometabola of Packard and of Scudder, while the Metabola are still entirely wanting. But of the Heterometabola the Coleoptera are entirely wanting.

Between the Orthoptera and Neuroptera is placed the new order of Neurorthoptera, with the sub-order of Neurorthoptera in a special sense, and the Palæodictyoptera of Goldenburg; the first of these suborders embraces two families, the progenitors of the recent Phasmidæ, the Protophasmida, with genera containing the colossal forms: Protophasma, Lithophasma, Titanophasma and Archegogryllus, and the Stenaropterida with three genera.

To the Palæodictyoptera belong the Stenodictyoptera with the genera Eugereon Gold., Haplophlebium Scudd., Goldenbergia Scudd., Dictyoneura Gold., and two new genera wholly without recent representatives; in addition, the Termes-like Hadrobrachypoda, with Miamia Scudd., and the new genus Leptoneura, besides the wholly extinct Platypterida provided on the end of the abdomen with two filaments, which belong to the three genera, Lamproptilia, Zeilleria and Spilatera.

In the Pseudoneuroptera Brongniart places the wholly extinct family of Megasecopterida, with eight new genera whose relatives in part bore respiratory appendages on the abdomen, a group to which also belongs de Borre's much-discussed *Breyeria borinensis*. Also a family of Protodonata, regarded as the forerunners of the recent Libellulidæ, with Protagrion n. g. Likewise, thirdly, the family of Homothetida Scudder; also, new families, the forerunners of the recent ones, viz: the Protephemerina, Protoperlida and Protomyrmeleonida.

Of the Hemiptera five different genera belonging to the Homoptera have been found, among which belongs, in Brongniart's opinion, *Phthanocoris occidentalis*, erroneously regarded by Scudder as a Heteropteron.

PLATEAU'S EXPERIMENTS ON VISION IN INSECTS.—The question whether insects can distinguish the form of objects is asked by Professor Plateau in a communication to the Royal Academy of Belgium. He rejects the mosaic theory of vision proposed by Müller, following Exner in his essay on the perception of movements, and on the theory of compound eyes, presented to the Vienna Academy in 1875.

The work of Exner, says Plateau, leads to the theoretical deduction that insects and other Arthropods possessing compound eyes do not distinguish the form of objects. Exner supposes that, in the Articulates and in many other animals, vision operates in a different way from that generally admitted, and consists mainly in the perception of movements. He enumerates, in support of his thesis, a series of important facts. In man the power of plainly distinguishing forms only belongs to the central part of the retina, while we perceive movements very well by the aid of the peripheral region of this sensitive layer.

Most animals, both vertebrates and invertebrates, seem but little impressed by the form of their enemies or of their victims, but their attention is immediately excited by the slightest displacement. Hunters, fishermen and entomologists have made in this respect numerous and demonstrative observations.

Finally, though the production of an image in the facetted eye of the insect or the crustacean seems impossible, we can easily conceive how the Arthropod can ascertain the existence of a movement. Indeed, if a luminous object is placed before a compound eye, it will illuminate a whole group of simple eyes or facets; moreover the centre of this group will be clearer than the rest. Every movement of the luminous body will displace the center of clearness; some of the facets not illuminated will first receive the light, and others will reënter into the shade; some nervous terminations will be excited anew, while those which were so formerly will cease to be.

In résumé, careful physiologists, relying on the structure of the compound eyes of Arthropods, admit that these animals do not see the form of objects, but only perceive colors and movements. Their facetted eyes are not complete visual organs, but simple organs of orientation.

Plateau then details the experiments he made to determine this question; and which we cannot well abstract. He calls attention to one result of his experiments: that insects only utilize their eyes to choose between a *white* luminous orifice in a dark chamber, or another orifice, or group of orifices, *equally white*. They are guided neither by odorous emanations, nor by differences of color. A fact which will certainly astonish all entomologists and likewise surprise the experimenter himself is, that bees have as bad sight and comport themselves almost exactly as flies.

From numerous experiments on Diptera, Hymenoptera, Lepidoptera, Odonata and Coleoptera, Plateau comes provisionally to the following conclusions:

1. Diurnal insects have need of a quick, strong light, and cannot direct their movements in partial obscurity.

2. In diurnal insects with compound eyes, the simple eyes offer so little utility that it is right to consider them as rudimentary organs.

3. Insects with compound eyes do not notice differences of form existing between two light orifices, and are deceived by an excess of luminous intensity as well as by the apparent excess of surface. In short, they do not distinguish the form of objects, or, if they do, distinguish them very badly.

THE DIVISION OF THE SEXES OF HYMENOPTERA.—We translate in a rather clumsy way Fabre's interesting article on this subject, published in the *Annales des Sciences Naturelles* (Tome XVII, Nos. 5 and 6). The entire article should be read to understand the subject.

The Osmias, the Chalicodomas and, as the closest analogies show, a great number of other honey-making Hymenoptera, arrange their egg-laying in female at first and then in male cells, when the two sexes have a different size and require unequal quantities of nourishment. If there is an equality of size between the two sexes, the same succession may exist, but less constantly.

This binary arrangement disappears when the place chosen for the nest is not large enough for the entire egg-laying. Then partial egg-layings occur, composed both of females and of males, and in harmony, as to their number and distribution, with the disengaged space.

To be able to give to each larva the room and the nourishment which it needs according to whether it is male or female, the mother decides the sex of the egg she is about to lay. According to the conditions of the home, often the work of another or a natural habitation slightly or not at all modifiable, she lays at her will either a male or a female egg. The division of the sexes is subject to her will.

The same prerogative belongs to the carnivorous Hymenoptera, the sexes of which have a different shape, and therefore need one more, the other less food. The mother must know the sex of the egg she is about to lay; she must dispose of the sex of this egg so that each larva shall obtain the right amount of food.

In a general way, when the sexes are of different size, every insect which collects the living prey, which prepares or at least chooses an abode for its offspring, must decide the sex of the egg to satisfy without error the conditions imposed upon it.

It remains to tell how this elective determination of the sexes is made. I do not absolutely know, I have never understood this delicate problem but attribute it to some fortunate circumstance which it is necessary to know or rather to watch for.

ENTOMOLOGICAL NEWS.—From a series of experiments by Professor Graber, says *Nature*, Oct. 22, relating to the effects of odorous matters on invertebrate animals, it appears probable that in the case of many insects neither the antennæ nor the palpi can be absolutely pronounced the most sensitive organ of smell, inasmuch as the one organ is most sensitive to some odorous matters, and the other for others.——Apropos of Hickson's account of the structure of the eyes of insects in our last number, we may say that, in 1883, B. T. Lowne published a paper in the Proc. Roy. Soc. London, of which an abstract has been published by Dr. Mack in *Psyche*, as follows: The author claims four forms of eyes: simple ocellus, compound ocellus (larval insects), aggregate (Isopoda) and compound eye. A brief description of each is given. Discarding all previous theories of vision by compound eyes, it is held that "a continuous picture, a mosaic of erect magnified central portions of the several subcorneal images, falls upon the retina."——Kraepelin (Ueber die geruchsorgane der Gliederthiere), Osterprogram der Realschule des Johanneums, Hamburg, 1883, gives an historical sketch of the olfactory organs of Arthropods, followed by a bibliographic list (59 numbers) grouped according to the languages in which the articles were written. He criticises the results of others, and compares them with his own observations on several crustacea, beetles, chrysopa, Orthoptera, butterflies, flies and Hymenoptera (*Psyche*, 296).——In the Annales des Sciences Naturelles (XVII, Nos. 5 et 6) is an interesting article by J. H. Fabre on the division of the sexes in the Hymenoptera; it gives the results of many years observations on the subject which we refer to more at length elsewhere.——The Transactions of the American Entomological Society (XII, No. 2) contain several papers by Dr. Horn, viz: Descriptions of new North American Scarabaeidæ; Contributions to the Coleopterology of the United States; Descriptions of new Cerambycidæ, with notes; Synopsis of the Throscidæ of the United States; while Mr. F. Blanchard discusses the species of Canthon and Phanæus of the United States, adding notes on other genera; and Mr. W. H. Ashmead remarks on the cynipidous galls of Florida, giving descriptions of new species.

ZOOLOGY.

Living and Dead Protoplasm.—Dr. Oscar Loew read an important paper before the British Association on a chemical difference between living and dead protoplasm. Protoplasm, it was found, contains certain aldehyde groups, which account for the extreme mobility and readiness of change in living protoplasm. These aldehyde groups can be reduced by alkaline silver solution. Spirogyra, one of the lower algæ, acts on this solution in a peculiar way. Living protoplasm reduces the salt, while dead protoplasm does not. The specific gravity of the protoplasm of Spyrogyra was increased, and was found to contain silver deposited in its interior. Argyria, or the effect of nitrate of silver on the human subject in certain diseases, was found in these algæ. Thus was shown a specific chemical difference between living and dead protoplasm. Ordinary poisons, such as prussic acid and strychnine, seem to have no particular effect on lower organisms, while the poison irresistible by all protoplasm is hydroxylamyl. Professor Burdon-Sanderson said that this investigation had more importance than might at first appear, for it had arisen out of the epoch-making paper of Pflüger. Pflüger concluded that there must be a chemical change in the transition from living to dead protoplasm, and Dr. Loew took up the question as to what exactly this change was. His investigations are an important step in deciding this important question. Professor Stirling said this gave a new test for living protoplasm. The chief thing to settle was what exactly causes reduction of the silver.

SPHÆRULARIA IN AMERICA.—In 1836 Léon Dufour described (Annales des Sciences Naturelles, ser. 2, v. 7, p. 9), a peculiar vermiform parasite, which he found in *Bombus terrestris* and *B. hortorum*, to which he gave the name of *Sphærularia bombi*, placing his new genus among the entozoa. In noting the occurrence of this genus of parasites in America, it may not be out of place to give some further account of it because of its unique structure and metamorphoses, and to enable its easy recognition.

Dufour's description reads: "Teres, albido-pellucida, mollis, filiformis, haud annulata, undique sphærulis vesiculæ formibus granulata, antero posticeque obtusa subrotundata." He adds in the French notes which accompany the above description that the length is 6–8 lines, that it is not very slim since it is about a line in diameter, that it shows no distinction of head or tail, being obtuse or rounded at both ends, and that all the surface, both above and below, is covered with spheroidal granulations which are like subdiaphanous vesicles.

Von Siebold, in 1838, wrote of this worm, and mentioned finding its young in bees, and that the young differed greatly from the supposed adult in having smooth skin. From the active young he saw that the worm belonged to the nematoids, but in the supposed adults, which were all females, he could discover no motion. He further notices that its digestive apparatus differs from that of all nematoids.

Siebold and Stannius write, "One finds neither mouth nor anus in *Sphærularia bombi*, and the intestinal canal is replaced by a series of elongated cells, adhering together, and around which the genital organs are entwined."

The next naturalist to investigate this curious animal was Lubbock, who published, in 1861, in the *Natural History Review*, a paper "On *Sphærularia bombi*," illustrated by a plate. Lubbock discovered at one end of the body which Dufour had described a minute nematoid worm, and wrongly thought this minute worm to be the male in copulation with the large body which was the female. In describing the so-called male, he is careful to state that he had not been able to distinguish any generative organs or any trace of spermatozoa, and discusses the possibility of the appended worm being a parasite of Sphærularia, or even its larval skin. Lubbock, whose article is very interesting, describes the anatomy of the so-called female, and states that it has "no muscles, no nervous or circulatory systems, and no intestinal canal," and that "the interior of the body is wholly occupied by two relatively enormous organs—the double series of secretory cells, and the ovary." The double series of cells he terms the *corpus adiposum*, and homologizes it with the intestine of other nematoids. Lubbock mentions briefly the prolificacy of Sphærularia, and the mode of development of its eggs. He discovered that the parasite was only present in large females of Bombus, but he was unable to trace its metamorphosis, and to discover how the bees were infected.

In a later paper Lubbock gives a brief account of his further studies on Sphærularia. He succeeded in keeping the young alive several weeks in water, and suggests that the young pass from moist earth into the bees while the latter are going about in moss and damp grass. He found half-grown females of Sphærularia, but still always with the so-called male attached, and he calls attention to the peculiar cell-structure of the so-called females.

Schneider was led by the cell-structure of the so-called females, and by the organic union between them and the little worm at their end, a union at a point where the sexual opening should be, to express the opinion that the so-called female was the evaginated and full-grown ovary of the little worm to which it was attached. Schneider's opinion, derived from structure, awaited proof based on observation, and this has at last been furnished by Leuckart.

Leuckart, in a preliminary communication in the *Zoologischer Anzeiger* of this year traces the evagination of the genital organs of the female to form the appendage which was so long regarded to be the female itself, the subsequent growth of the appendage, and the origin and homological significance of its parts. This worm-like body may even lose the minute female from which it was originally an evagination even before its eggs are ripe.

Lubbock, in the paper already mentioned, and Linstow, in his "Compendium der Helminthologie," enumerate the species of Bombus in which *Sphærularia bombi* has been found; the former author gives their relative abundance in different species of bees, and states that the number of Sphærulariæ usually present in a single bee is from four to eight, but in one specimen he obtained no less than thirty-four, the greater number of which were full-grown. In some European species of Bombus one-half the large females which have hibernated contain these parasites in May and June.

Wishing to see if Sphærularia was to be found in America, I examined ten specimens of Bombus taken on the 10th of June last, in Cambridge, Mass. The species of Bombus were not determined. Only two of the specimens were parasitized; in one was a single Sphærularia, in the other were two. The Sphærularia found single was 2.9 centimeters in length; each of the other specimens was a trifle shorter. Nothing seemed to indicate that the specimens found in the American bees were other than *Sphærularia bombi*, except that they were a trifle larger than the size usually given for that species. Dufour states the length of *S. bombi* to be from "6–8 lin.," Lubbock "nearly one inch," and Leuckart "1.5 cm." Further examination of females of determined species of bees, at the time when they come from their winter retreat, and more specimens are necessary to know whether Sphærularia is as abundant here as it is in Europe, and whether the species is the same.—*George Dimmock.*

NOTES ON SOME EASTERN IOWA SNAILS.—During the past season I have taken several interesting species new to the vicinity of Davenport, Ia. Among them the *Gundlachia meekiana* Stimp., a shell not before reported from the West. The specimens are decidedly larger than Stimpson's types, and extremely variable—some of them agreeing exactly with the description and figures of the *G. stimsoniana* Smith and Prime, and plainly indicating the specific identity of the two forms. As Stimpson writes, the septum in the aperture of Gundlachia seems to be formed at the end of the first season's growth; but numbers of *these* limpets formed no plate, simply adding the second season's growth on the margin of former peristome, thus making a real *Ancylus* with black conical cap. Lily pads seem to be their favorite station. Each limpet eating an irregular area on the under side, but never perforating the leaf.

Numerous specimens of the *Pyrgula scalariformis* Wolf, unnoticed since the publication of the original description nearly twenty years ago, were found near the mouth of Rock river, a few miles below Davenport. The validity of this species has recently been questioned by Mr. R. E. Call, who refers it to *Pomatiopsis lapidaria* Say! The specimens taken leave no doubt concerning the position of these tiny snails in the genus Pyrgula—unless the anatomy show greater divergence from that type than the shell. Our Rock river specimens are smaller, stouter than typical fossil *scalariformis*, and more compactly coiled—never exhibiting the peripheral carina on upper whorls. The shorter forms remind one of the common rhomboidal variety of *Anculosa dissimilis* Say. These have been distributed by the writer to correspondents under the varietal name of *P. scalariformis mississippiensis.*

Observations on Mississippi river Lioplax tend to confirm the opinion of the late Jas. Lewis, that the eastern and western Lioplaces are especially distinct. The foot in our specimens only slightly exceeds the shell in length, while Binney's figures (of the eastern form) represent it nearly double the length of shell.

My measurements were taken while the animal was in rapid motion—its greatest length being then attained.—*Harry A. Pilsbry.*

THE BATRACHIAN INTERCENTRUM.—The determination of the homologies of the segments of the vertebral centra of the rhachitomous and embolomerous batrachians is a question of importance in the history of the evolution of the three classes of land Vertebrata, the Batrachia, the Reptilia and the Mammalia. I have already made such determinations, but Professor Gaudry subsequently made different ones, and in this he is followed by the European palæontologists, especially by Fritsch in his Fauna der Gaskohle der Permformation Bœhmens. I have reëxamined this question, and with the aid of new material I am able to reach further definite conclusions in the matter.

The facts which I have discovered are the following:

I. In the Pelycosauria the chevron bones form a continuum with the intercentrum[1] (hypocentrum Gaudry).

II. In the caudal vertebræ of Eryops also (Rhachitomi), the chevron bones form a continuum with the intercentrum.[2] I therefore believe the intercentra of Clepsydrops and of Eryops to be homologous parts.

III. In the caudal series of Cricotus[3] (Embolomeri) the intercentra are as large as the centra, and except that they form a continuum with the chevron bones, resemble them, and take part with them in supporting the neural arch.

IV. In the dorsal region of Cricotus the neural arch loses its articulation with the intercentrum and stands exclusively on the centrum.[4] The serial homologies of the centra and intercentra are readily traceable in this genus throughout the column.

In spite of these facts Dr. Fritsch and others regard the intercentrum of the Rhachitomi (hypocentrum of Gaudry) as the true centrum. His reasons for this course are the following:

I. In the caudal region of Sparagmites and Diplovertebron the neural arch stands on the intercentrum,[5] so that it is easily mistaken for a centrum.

II. In the dorsal region in Chelydosaurus and Sphenosaurus, the neural arch stands above or on the intercentrum, while the centrum (pleurocentrum and hypocentrum pleurale) is reduced in dimensions.

III. It thus results that the small hypocentrum pleurale resembles the intercentrum of the Reptilia and certain Mammalia, rather than the centrum, to which it truly belongs.

I am of the opinion that the homological determinations of Gaudry and Fritsch, in this matter, are erroneous, and for the following reasons:

I. The neural arch being free may change its articulation from

[1] Proceedings Amer. Philosoph. Soc., 1878, p. 510.

[2] Loc. cit., 1880. Pal. Bulletin, No. 32, p. 15, Pl. III. fig. 5.

[3] Loc. cit., 1878, p. 522.

[4] Loc. cit., 1878 522, and 1884, p. 29. Dr. Fritsch has overlooked these references, and wrongly believes that the complete intercentra of Cricotus are confined to the caudal region.

[5] Fauna der Gaskohle, Bd. II, Heft I, Pl. 50, fig. 14, 15–16.

centrum to intercentrum and *vice versa*, while the chevron bones being continua, cannot do so.

II. The neural arch actually does shift its position in Cricotus. In the posterior part of the caudal series it is principally on the intercentrum; in the dorsal region it is on the centrum.

From the preceding considerations I get the following important results:

I. The principal vertebral bodies in the Sphenosauridæ[1] (Sphenosaurus and Chelydosaurus), if Fritsch's descriptions be correct, are intercentra and not centra.

II. It is probable that the true centra become extinct in the batrachian descendants of this family, so that the solid vertebræ of such Batrachia are intercentra, and not centra.

III. The characters of Cricotus on the other hand point to the extinction or reduction of the intercentra as we find it in the pelycosaurian Reptilia, and point to the probability of the Embolomeri being ancestors of the Reptilia, as I have already suggested.[2]

IV. The Sphenosauridæ (which must also include Sparagmites) are intermediate between the Rhachitomi and the Embolomeri, resembling rather the latter in the completion of the true centrum, but resembling the former in the incompleteness of the intercentrum.

I note here that Dr. Credner[3] does not understand why I should have overlooked the discovery of the rhachitomous structure of Archegosaurus by Von Meyer forty years ago. I think any one who examines Von Meyer's description and figures will find ample reason why one should not see the rhachitomous structure in them, without overstepping the bounds of scientific caution. And it is evident that European naturalists did not recognize this structure, as they make no mention of it during those forty years, although specimens of Archegosaurus are abundant; but rather frequently referred Archegosaurus to the Labyrinthodontia, which are described as having the vertebræ undivided.

I had hoped to have given before now engravings in quarto of these important forms, but the present U. S. Geological Survey having suspended my work, I am unable to do so.—*E. D. Cope.*

EMBRYOLOGY.[4]

THE DEVELOPMENT OF THE TOAD-FISH.—The development of the Batrachidæ is not well known, as will appear from some of the statements in systemetic treatises. One author states that: "The young of some or all the species fasten themselves to rocks by means of an adhesive disk, which soon disappears."

It is the purpose of this notice to point out that the adhesive disk referred to above is of a wholly different nature and origin from that found in the lump-fishes and Gobiesocidæ in which such

[1] Cope. NATURALIST, 1885, p. 592.

[2] AMERICAN NATURALIST., 1884, p. 37.

[3] Die Stegocephalen aus dem Plauenschen Grundes bei Dresden; Zeitschr. Deutsches Geol. Gesellsch., Berlin, 1885, p. 721.

[4] Edited by JOHN A. RYDER, Smithsonian Insti tution, Washington, D. C.

a disk is formed by the confluence or coalescence of the pectoral pair of fins.

The adult toad-fish burrows a cavity under one side of a submerged boulder, and to the solid roof of this cavity the female attaches her ova in a single layer. The eggs are very adhesive and quite large, measuring about one-fifth of an inch in diameter. Like the male cat-fish, the male toad-fish assumes charge of the adherent brood of eggs and remains by them until they are hatched and subsequently become free.

The egg-membrane or zona radiata is very firm, and adheres to the under surface of the stone by a discoidal area about 3^{mm} in diameter. The free globular pole of the egg is accordingly directed downwards. The germinal disk is developed at the lower pole and gradually spreads so as to enclose the vitellus from below upwards. The result is that the embryo is formed upon the lower or free pole of the egg, where it develops until it finally ruptures the egg membrane, when it may be said to have hatched, but, unlike all other types of fish-embryos known to me, the young fish does not at once drop out of the egg-membrane when the latter is ruptured. This is prevented by the adhesion of the ventral (now upper) pole of the yolk-sack to the inside of the egg-membrane just before the latter is ruptured. Just how this secondary adhesion of the yolk-sack is effected has not been determined, but the adhesion persists until the embryos are considerably over one-half inch in length.

In the course of the development of other parts, the yolk-sack is finally constricted horizontally round the middle below the body of the embryo, and becomes hour-glass-shape. This is due in part to the down growth of the mesoblastic somites on either side of the yolk from above; as a result of this a part of the yolk becomes intra-abdominal while a part of it remains for a time in the lower bulb of the yolk-sack and outside of the true abdominal cavity. Eventually the whole of the yolk becomes intra-abdominal; this is due in part to its further absorption and the further development of the abdominal walls of the embryo, but during all of this time, or until yolk-absorption is completed, the embryo remains adherent as described above. At this stage the embryo is so far developed that it would be recognizable as belonging to the genus Batrachus.

The pectoral and pelvic fins develop as very short folds which are close together, the latter arising almost immediately behind the former. In the course of further development, the pelvic fins are suddenly translocated forwards in advance of the pectorals, and are finally brought to lie near the constriction in the yolk-sack and just above the lower bulbous portion of the latter. It will therefore be obvious to any one that neither the pectoral nor pelvic fins have anything to do with causing the adhesion of the embryos, for both of these fins arise far above the point where the young fish is adherent.

The paired spinal nerves which pass to the pelvic fins are caused to cross those passing to the pectorals, because of the sudden translocation of the former pair of fins already alluded to.

It has also been stated by authors that Batrachus possesses no lateral line. This is an error, for the writer found that the neuromastic grooves or furrows, which remain open for a considerable time on the heads of the larvæ, are continued into a lateral line system on the sides, a condition of things which is also very evident in the adult, if the latter is carefully examined. There are also series of efferent pores present in the adults. The lateral neuromastic canal bifurcates in the vicinity of the shoulder-girdle and sends a dorsal branch backward below the base of the dorsal, and a ventral branch above the base of the anal. These two canals run nearly parallel along either side of the body and even extend backward upon the tail, as shown by some fine preparations of the skin of the embyro mounted by Professor Libbey, of Princeton.

Another point of some interest is the fact that the entire brood of young embryos upon any one stone have their heads directed one way and toward the light, which comes in at one side of the little retreat prepared by the adults. This is very remarkable and seems to indicate that the direction whence the light comes has some influence in determining the direction in which the embryonic axis will be formed in the blastoderm.

Very active movements of the tail, and especially of the pectoral fins, begin as soon as these parts are fairly developed; these movements become more energetic toward the close of the fixed stage of existence of the young toad-fish. It is very probable that the active wriggling movements of the young embryos finally frees them from the surface to which they are firmly glued by some adhesive material secreted by the yolk-sack, but which, like that which in the first place caused the egg-membrane to adhere, is not soluble in water.

The yolk is peculiarly homogeneous and does not readily coagulate or harden in the presence of ordinary reagents, such as chromic acid, as long as the egg-membrane is intact. There are no oil-drops present and the ova are much heavier than their own volume of sea-water. The number of ova found in one brood varies considerably, but it does not seem that there are ordinarily much over two hundred laid in one place. They are dirty-yellow in color and very firm to the touch, with a very narrow space between the vitellus and enveloping egg-membrane.

The development of the toad-fish is peculiar, if not unique, in presenting a prolonged fixed stage after the period of hatching or escape from the egg-membrane is over, during which all or nearly all of the yolk is absorbed. The embryo is therefore finally set free, without being encumbered by a heavy yolk, such as is met with in the embryos of the salmon. Such a provision obviously has its advantages, especially since the young are also guarded by the male parent during the period of their helpless fixation. One may frequently find recently hatched embryos, around the affixed pole of the yolk-sack of which shreds of the ruptured egg-membrane still adhere; during the later stages such shreds are not usually visible. There is a decidedly heterocercal tail developed from a special tail-fold, since there is no absolutely continuous median fin-fold developed, as in many other forms.

Oviposition occurs about the middle of July, in the latitude of Wood's Holl. How long it lasts has not been determined, but judging from the condition of the roes and milt of the adults at that time, it seems very probable that they do not spawn later.—*John A. Ryder.*

PHYSIOLOGY.[1]

CONDITIONS WHICH DETERMINE COAGULATION OF THE BLOOD.—Herr Holzmann adds something to our knowledge of the conditions of blood-clotting. His results are summed up as follows: 1. A body called fibrinogen, belonging to the class of globulins, can be obtained from horse's blood, and solutions of fibrinogen neither coagulate spontaneously at ordinary temperatures nor upon dilution with water. 2. Defibrinated blood, blood serum, watery extract of the albuminous coagulum formed in blood serum by the addition of alcohol, or the extract obtained from egg-albumin coagulated in the same way, the putrescent fluids obtained from cooked egg-albumin, and long-continued passage of oxygen, all cause typical coagulation of the solution of fibrinogen at ordinary temperatures, with the production of fibrin. 3. Fibrin-ferment is not peculiar to the blood, but occurs among the decomposition products of albumin. 4. It is probable that fibrin is the product of the oxidation of fibrinogen. 5. When a dog is rapidly bled to death (one and a half to three hours), the last portions of blood drawn clot quicker than the first, though the amount of fibrin formed does not markedly vary. 6. Venous blood clots more slowly than arterial blood; suffocation delays coagulation. Curare, chloralhydrate, chloroform, quinine and soda carbonate, also delay the coagulation.

SPECIAL PHYSIOLOGY OF THE EMBRYO.[2]— The last of the four separately issued parts of this work having now appeared, it becomes possible to speak of it as a whole. It may be said that the author has done for the physiology of the embryo what Balfour did for the morphology in his *Hand-book.* Some of the researches described here are closely connected with those on new-born children described in the author's previous work, *Die Seele des Kindes,* to which he has frequently occasion to make reference. His most important general results are that mobility appears long before sensibility, and that the sense-organs and the parts of the

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.
[2] By Professor W. Preyer, Leipzig, 1885. pp. XII. 644.

nervous system connected with them are capable of functioning before it is at all likely that in normal embryonic life they have any proper functions to perform. By "mobility" is to be understood more especially the power of making spontaneous or "impulsive" movements. The presence of sensibility can only be proved by the existence of what is really a kind of mobility—that is, reflex mobility. When the appropriate reflex movements are obtained on stimulating the sense-organs it is inferred that the corresponding kind of sensibility is present. Reflex movements are not only later in appearing, but can also be made to disappear more easily than impulsive movements. The movements that indicate sensibility can be suppressed (in the artificially extracted embryo of the rabbit) by applying chloroform to the skin; with more difficulty by causing chloroform to be breathed. In either case the anæsthesia passes off very rapidly. It is supposed that the chloroform in the first case acts directly, in the second case, indirectly, on the nerves of the skin; that it only secondarily affects the spinal cord, and that it does not act at all on the brain. The movement of sensibility in the embryo gradually rises from its first appearance up to birth. In the embryo of the rabbit, the skin being irritated, two seconds may pass from the contact to the reaction. The occurrence of respiratory movements is dependent on the power already present of reflex movement in response to stimuli on the skin, not the power of reflex movements on respiration. Little has been ascertained with regard to the sense of temperature and the muscular sense; the fact that mobility is increased by warmth, diminished by cold, of course proves nothing as to the sense of temperature properly so-called. The human fœtus gives signs of having feelings of taste two months before birth. The whole complex of parts belonging to the ear is functionless before birth, as are also the parts of the eye; but the power of raising the eyelid is present; the eyes are not closed in the human embryo after the sixth month. The conditions for the organic feelings are present several weeks before birth; pleasure and pain can be distinguished. The author finally puts the question, What is the actual state of the embryo normally? He arrives by a series of arguments that seem pretty conclusive when taken together, at the result, that its state is normally like dreamless sleep or like the state of a hibernating mammal; it does not wake up from this state before birth except momentarily, and then only when strongly stimulated.—*Mind, No. xxxvii, pp. 152.*

ARE THE MUSCLES DEAD OR ALIVE DURING CADAVERIC RIGIDITY?—Professor Brown-Sequard has demonstrated that for several weeks after death, or as long as *rigor mortis* persists, the muscles of an animal undergo slow alternate contractions and elongations. The movements were only perceptable when one or the other set of a group of antagonistic muscles was divided, and they ceased totally when cadaveric rigidity finally passed away.

The movements were determined by measuring the angles through which a limb was turned, and also by obtaining on a rotating cylinder a graphic tracing representing the rate and extent of the muscular change. A dog was killed on October 6th, and on the 15th one hind limb was fastened in extension and the angular movements of the foot observed; on the 15th, the angle formed by foot and leg was 34°; on the 16th, 32°; the 17th, 16°; the 22d, 12°; the 25th, 21°; the 28th, 23°; the 30th, 18°; the 31st, 20°; November 4th, 23°. The rigidity still persisted on November 8th when the observations were described.

These movements are absolutely independent of external conditions, temperature, moisture, etc. In fact, in the same animal, while some of the rigid muscles are elongating, others are contracting and still others are at rest. Professor Brown-Sequard comes to the startling conclusion that these movements prove that the muscles in *rigor mortis* are not dead, but are still endowed with vital powers, but, however, are in a certain chemical condition which is antecedent and preparatory to final death.—*Comptes Rendus, T. ci, p. 926.*

GLANDULAR AND VASO-MOTOR FIBERS OF THE CHORDA TYMPANI AND GLOSSOPHARYNGEAL NERVES.—Professor Vulpian has renewed after a new method his researches on this important and difficult subject. Curarised dogs were operated on in such a way that the cranial nerves could be stimulated by an induction current at their points of origin within the skull. The nerves were usually laid intact upon the electrodes; reflex effects failed, probably because the appropriate nerve centers were injured in the operation. M. Vulpian concludes that both the glandular and the vaso-dilator fibers of the *chorda tympani* leave the medulla with the facial but none of them come from the trigeminal nerve. It is certain, apparently, that the chorda tympani, besides its glandular and vaso-dilator filaments, supplies to a large extent the anterior two-thirds of the tongue with sensory nerves of taste.

Stimulation of the facial nerve at its origin causes an abundant flow of saliva from the sub-maxillary gland on the same side, but none from the parotid gland, and intense congestion of the anterior two-thirds of the corresponding side of the tongue. Stimulation of the glossopharyngeal nerve at its foramen of exit from the skull causes congestion in the posterior third of the tongue on the same side and secretion from the corresponding parotid gland. When the trigeminal nerve is excited in the same way, no secretion is obtained, nor is there any vaso-motor change in the mucous membrane of the tongue.

The geniculate ganglion is a trophic center for the chorda tympani, for, after intra-cranial section of the facial nerve, the fibers of the chorda contained in the latter remain intact while all the others degenerate.

Though not bearing directly on the present subject, it is important to observe that Vulpian has succeeded in separately stimulating near their origin both the spinal accessory and the pneumogastric nerves. Excitement of the first named alone causes arrest of the heart, while both are able to set up movements in the stomach and other organs. Stimulation of the pneumogastric seemed to have no influence upon the circulation or the secretion of the mucous membrane of the stomach.—*Comptes Rendus, T. ci, p. 851.*

PSYCHOLOGY.

THE MATERIAL CONDITIONS OF MEMORY.—The greatest possible importance attaches to the question of the physical conditions of consciousness, but the investigation of it is surrounded with great difficulties. One of the most available points of approach is by a study of the characteristics of memory. Memory may be defined as *intermittent or recurrent consciousness;* and it follows that whatever produces or destroys memory is also a cause of the appearance or disappearance of consciousness. I refer especially to reminiscence, or the recurrent consciousness of a previous impression, as that part of memory which gives it its importance in this connection.

Memory is reasonably understood to be the result of an impression made on a physical basis of consciousness by some stimulus. The structure of this matter is affected, so that on the recurrence of consciousness within it, the consciousness takes the form or character of the modified structure it finds there. Important information as to the effects of different stimuli may therefore be gained by a consideration of their relative capacities for reproduction in the reminiscent phase of memory. On this point the following propositions may be considered:

There are two sources of impressions which reappear as memories; those from the subject or subjective activities of the mind, and those from objects or things external to the mind. Before considering these, it is necessary to guard against confounding the recollection of the occurrence of an event, with the recollection or reminiscence of the sensations which constituted that event. Thus one can remember that he reached some conclusion in a given discussion, but may be unable to remember the conclusion itself. He may remember that he was angry, but be quite unable to reproduce the passion. He may remember that he had a toothache, but may be unable to reproduce the suffering itself.

Subjective stimuli are of the two classes into which all mental acts fall, the intelligent and the emotional. Objective stimuli belong to the pains and pleasures of all parts of the body, and to the special and general senses. To what extent are all these phases of consciousness susceptible of reproduction in the reminiscent part of memory? There is a kind of memory not strictly reminiscent, which may be well termed, *recognition.* The difference between reminiscence and recognition is this. In reminiscence the peculiar form of consciousness is actually reproduced, according to the law of associated ideas; in recognition the recurrence of the original stimulus is necessary to arouse memory; otherwise the sensation would not return to consciousness. The former is evidently the stronger and truer form of memory, and as it answers our purpose best, and is most easily examined, I confine my attention to it for the present.

This much being understood, it appears to me that the following propositions may be maintained:

I. That objective impressions are less profound than subjective, the capacity for reminiscence being the index.

II. That of the objective, those introduced by the special senses are more profound than those introduced by the general senses.

III. That of the former, those introduced by supposed vibrations (sound, sight) are more profound than those produced by supposed contact of matter (taste, smell).

IV. That of subjective impressions, those produced by acts of intelligence are more readily and exactly reproduced, than are those produced by the emotions.

These propositions might be illustrated at great length, but for the present I content myself with the following:

II. The pleasures and pains of general sensation cannot be reproduced by an act of memory. No one can reproduce any particular pain for instance. It is probable that pleasures and pains which are characteristic (locality being left out of account), can be more or less *recognized* on their recurrence, showing that they make a real, but comparatively slight impression on the physical basis ofconsciousness.

III. No one can reproduce a taste or a smell with the same degree of distinctness that is possible in the case of a sound or a sight. Most persons cannot reproduce them at all. As to sounds, the reproduction is very imperfect; and although the reproduction of visible objects is, in most people, more distinct, it is short of the reality of seeing.

IV. Mnemonic reproduction of an emotion is not difficult, but falls short of the emotion itself, even in the most pronounced cases. Although emotions leave behind them deep impressions, they are plainly evanescent, in some persons more so than in others. Nevertheless a reproduced emotion is more distinctly like the original than is a reproduced sight.

Of processes of the intelligence, those of the imagination are reproduced with great precision and clearness in most persons, but not more so than processes of reason. It is only in the intelligence that it is safe to say that the reproduction or reminiscence is identical with its original. It is true that the impression may be evanescent here also, but it is less so than in the case of an emotion. It is only in bad mental health that association fails to revive completely a process of intelligence. It is a consequence of this fact that intelligence is more cumulative in its character than emotion, and much more so than pleasure or pain. Could we reproduce in our consciousness sights, sounds and sensations as truly as we do thoughts, we would be different beings from what we are. And were they cumulative in our consciousness in the same sense that thoughts are, we would be still more different.

Thus there seems to be a relation between the nature of stimuli and their effects on consciousness, which may perhaps be formulated as follows: *The persistence of an impression on the physical basis of consciousness is in inverse proportion to its intensity in consciousness.* Thus the most violent and least permanent of impressions are molar, as in physical sensations. The intermediate are those of such special senses as are supposed to be the result of exterior vibrations. The most delicate and the permanent, are those produced by the supposed extremely rapid vibrations of living brain-tissue. These create an accustomed channel of apparently greater perfection of construction than do the more violent forms of consciousness, which are therefore longer preserved, and more readily followed by new arrivals of consciousness. The reason for this is to be found in the probable fact, which is also supported by other considerations, that the more violent forms of consciousness destroy more tissue, while the most delicate forms destroy less, rendering rearrangement more easy.

These considerations are of course applicable only to new stimuli, which are not mere repetitions of old ones, and are especially not applicable to the secondary stimulus furnished by reminiscence itself, in which are to be included dreams. That the materials of thought are often only reminiscences is no objection to the theory here presented; for the processes, and conclusions of thought are perfectly new experiences when first performed and attained. And the precision with which intelligent thoughts are reproduced is a guarantee of their persistence, since each reminiscence acts in some degree as a new stimulus. This is true of the simplest processes of intelligence in the lowest types of mind.

We can derive some hints from these considerations, as to the evolution of temporary and permanent states of consciousness.—*E. D. Cope.*

ANTHROPOLOGY.[1]

STONE PLUMMETS.—In the summer of 1884 Mr. H. W. Henshaw spent a portion of his vacation in Southwestern California, and while there was enabled to gather some information from the Santa Barbara Indians concerning the so-called stone plummets. They have been called sinkers, plummets, sling-shots, bolas, spinning-weights, fetishes and sorcery-stones. With reference to

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

these objects Mr. Henshaw says: "The moment the stones were shown to the Santa Barbara Indians, and without leading questions from me, I was told that they were "medicine or sorcery stones," used by the medicine men in making rain, in curing the sick and in various ceremonies." This opinion is maintained by the writer. A very ingenious supplement to this theory is suggested by Mr. John Murdoch, to the effect that objects of this kind were primarily sinkers. and that handed down to their present owners they would become invested with great sacredness. Assuming this, "it would eventually follow that the groove having no longer a special function would either disappear entirely or be only slightly indicated."

Polynesia. — The nineteenth volume of the Encyclopædia Britannica contains an extended article by S. J. Whitmee on the Polynesian peoples. There are three different types inhabiting these islands belonging to the two distinct divisions, the dark and the brown. These three types are the Papuan, the Sawaiori or brown Polynesians and the Tarapon or Micronesians. Mr. Whitmee's table given below shows his conception of the relationship of the various groups of islands to his three types:

		Races.	*Countries where found.*
Indo-Pacific Races of Men.	Brown people: Negrito-Polynesians	Austral	Australia,
		Negrito	Andaman Is. Samang, etc.
		Papuan	Aru Is. Western New Guinea. Solomon Is., etc. New Hebrides, etc. Fiji.
	Dark people: Malayo-Polynesians	Sawaiori	Samoa, etc. Hawaii. Cook Is., etc. Society Is., etc. New Zealand.
		Malagasy	Madagascar.
		Formosan	Formosa.
		Malayan	Malays of Sumatra, etc. Java, etc.
		Tarapon	Caroline Is. Marshall Is. Gilbert Is.

The history and migrations of the Sawaiori race are discussed very thoroughly. To the names Tarapon (from *Tarawa* and *Ponape*) and Sawaiori (from *Samoa*, *Hawaii* and *Maori*) objections of a potent character have been raised, but it is impossible to find an aboriginal word to cover the ground, and the question is purely one of scientific priority.

Annual Report of Progress.—The editor of these notes has for many years taken great pleasure in publishing a record of progress in anthropology for each year, with the resources at his control. The time will soon come when this work will be done systematically and at greater length, but until that time arrives some one must do the pioneer work. The board of regents of the Smithsonian Institution have changed their year from the fiscal to the calendar, making it necessary to hand in manuscript earlier. All anthropologists are most cordially requested to send to my address the titles of all their publications.

The "Indian Local Names," recently published by a school-teacher of York, Pennsylvania, Mr. Stephen A. Boyd, is a rather extensive collection of North American local names of Indian origin (there are but a few Central and South American names inserted), of which the interpretation is added or attempted. In an appendix we find etymologies of a number of topographic names from the Eastern hemisphere also. The undertaking is laudable, though difficult; for the compiler should not only be a copyist of etymologies given by others, but we expect him to be able to judge, which one of the ten or twelve explanations of one name is the correct one, and to do that he must have some knowledge of the language to which the name belongs. The local names of North America belong to more than 150 different dialects, and of all of these he who knows enough to pass a judgment on this matter, may fairly be regarded as the Pico de la Mirandola or the Mezzofanti of American linguistics. Mr. Boyd is not a man of this sort; for he does not even give the name of the language from which his copied interpretations are taken, and moreover we are often left the choice between three or four totally diverse etymologies of the same name. But in the preface he is candid enough to give his scientific authorities, which form quite an extensive list.—*Albert S. Gatschet.*

Anthropological News.—In Vol. 106 of the Transactions of the Austrian Academy of Sciences, philol.-hist. department (Vienna, 1884), Professor Dr. Friedrich Müller has published the paradigms of several *Koloshian* (or Thlinkit) nouns and verbs, based upon data contained in a rare publication of the priest, J. Wenjaminow (St. Petersburg, 1846). Guided by the principles governing the grammar of agglutinative language in general, Professor Müller by his publication intends to rectify several statements made by Professor Dr. A. Pfitzmaier upon the same linguistic subject.——The Abnáki dialect of the Passamaquoddy river, Maine, has been made the subject of an article read before the American Philosophical Society of Philadelphia, on Feb. 6, 1885, by Abbie Langdon Alger. This article consists of a vocabulary of words, phrases and sentences, in all about 450 items on fifteen pages; the accentuation is indicated by signs of length or macrons upon the vowels. The terms are not given after certain categories of objects, as parts of body, relationships, etc., and this makes it difficult to find in the long list any word that may be looked for. It would have been preferable to arrange the terms in alphabetical order.——Nearly one hundred geographic names from the State of Minnesota have been traced to their origin in the Dakota language in the thirteenth annual report of the State geologist of Minnesota, Professor N. H. Winchell (1884, pp. 104–112, 8vo). The author of the treatise, Professor A. W. Williamson, gives evidence of assiduous work in tracing the etymologies of all these village, lake and river names. The usual spelling of local names of Indian origin generally differs from their pronunciation by the Indians, which is the correct one; this Indian mode of spelling has therefore been added to each name, whenever there was necessity for it. His remark, that "most Dakotas very slightly nasalize all their vowels," must be, we think modified by adding the statement, that they do not nasalize the vowels in *every* word of the language, but in a large number of them.——Recent numbers of the Bulletin of the Torrey Botanical Club, New York, contains linguistic inquiries into the origin of plant names. Thus we find disclosures upon so-called Southern moss, Tillandsia, upon ginkgo (*Salisburia adiantiflora*), Cintractia, Savoyanne, a species of Coptis; this name is traced by W. R. Gerard, of New York, to a term appearing in several of the northern Algónkin dialects. All the above will be found in the July number of 1885. In the August number Mr. Gerard has an interesting article upon the *Indian peach*, which he states was introduced into North America both by way of Mexico and the Atlantic seaboard. The Indian equivalents are given at the close of the article.—*Albert S. Gatschet.*

MICROSCOPY.[1]

THE EYE OF INSECTS.—The following is a summary of some of the methods employed by S. J. Hickson[2] in the study of the eye of *Musca vomitoria:*

1. For making sections of the eye, it is best to dissect away the posterior wall of the cranium, and then expose it to the fumes of an osmic acid (1 p. c.) solution, 40 minutes, then to wash in 60 p. c. alcohol for a few minutes, and finally, to harden in absolute alcohol.

2. The ribbon method of sectioning can be employed with this species; but with most insects, owing to the hard chitinous cranium, it is necessary to cut, with the knife set obliquely, so as to get a long sweep at each stroke, and to remove the sections one by one.

3. The best method of depigmenting, is that of exposing the sections to nitrous fumes. The sections are fixed on the slide with P. Mayer's albumen fixative, the paraffine removed with turpentine, the turpentine driven off by absolute alcohol, and then

[1] Edited by Dr. C. O. WHITMAN, Mus. Comparative Zoology, Cambridge, Mass.
[2] Quart. Journ. Mic. Sc., xxv, April, 1885, p. 243.

the slide inverted over a capsule containing 90 p. c. alcohol to which a few drops of strong nitric acid have been added. Copious fumes are given off, and the pigment dissolves. The action can be arrested at any moment by washing with neutral alcohol.

4. The sections are next stained with hæmatoxylin or with any other solution. The best results were obtained with hæmatoxylin made after Mitchell's[1] formula.

For teasing the best solution is chloral hydrate. The preparation is left in a 5 p. c. solution for twenty-four hours, and then teased with needles and mounted in glycerine.

GRENACHER'S METHODS OF PREPARING THE ARTHROPOD EYE.[2] —*Hardening Fluids.*—Chromic acid and its salts produce a coarse granulation, and on this account must be considered objectionable. Oxalic acid, in aqueous or alcoholic solution, as recommended by M. Schultze and Steinlin, gives good results in some cases, bad in others. Picric acid gives wholly unsatisfactory preparations, while picro-sulphuric acid works well in many cases. The latter fluid, cannot, however, be used with most of the Crustacea, as here the integument contains calcareous salts which react with the acid to produce crystals of gypsum and carbonic acid, both of which work injury to the soft tissues. Merkel's chrom-platinum solution gives excellent results with some simple eyes (*e. g.* Phalangium and Acilius larvæ), but is unsatisfactory in the case of spiders and with compound eyes. Osmic acid, so highly recommended by M. Schultze, while it has some valuable qualities, is, on the whole, not very serviceable. It preserves, to a certain extent, the character of the fresh tissues, but it *renders the pigment less easily soluble*, lessens important differences in refrangibility (*e. g.* between the rhabdomeres and the protoplasm of the cells), and besides leaves the preparation brittle, so that good sections are not easily obtained.

The most serviceable hardening fluid for the compound eye is alcohol (70 p. c.–90 p. c.). The hyaline rhabdomeres generally remain clear and transparent, but lose their color and often a part of their refrangibility.

Bleaching.—The pigment is dissolved very rapidly by caustic potash, but this agent destroys almost equally rapidly other parts, even to the chitinous parts. The strength first recommended by Moleschott, 30–35 p. c., allows time for examination in detail. The best means of bleaching is found in nitric acid, first recommended for this purpose by Gottsche[3]. Gottsche used the full strength, M. Schultze, 25 p. c.; Grenacher employed 20–25 p. c., adding a drop to the sections lying in dilute glycerine, under the cover-glass. The demonstration of nuclei by means of the ordi-

[1] The Science Monthly, March, 1884.
[2] "Das Sehorgan der Arthropoden," p. 22–25, 1879.
[3] Müll. Arch. 1852, p. 486.

nary dyes, after the use of nitric acid, is very difficult. This can be accomplished, however, in the following simple way: Add only a trace of nitric acid to the prepared section, and leave it 12–24 hours. The pigment dissolves slowly, and is taken up by the nuclei, and thus acts as a stain. The preparations are not beautiful, but are quite clear and distinct, and can be mounted without danger of disturbing the pigment. A similar proceeding (pigment dissolved by acetic acid) has been described by Leydig.[1]

The following is another mixture employed by Grenacher, as given by Carrière:[2]

Glycerine	1 part.
Alcohol (80 p. c.)	2 "
Hydrochloric acid	2–3 p. c.

The preparations remain in this mixture until the pigment changes color and becomes diffuse.

METHOD OF EXAMINING THE REFLEX IN THE COMPOUND EYE OF INSECTS.—Lowne[3] recommends the substitution of a reflecting ophthalmoscope for the eye-piece of a microscope. "By this means a bright luminous spot may be observed as a real image in the tube of the instrument. A quarter objective must be used, and the mirror of the ophthalmoscope must be strongly illuminated. The microscope is then focused so that a real image of the corneal facets is seen between the objective and the eye of the observer. By bringing the object-glass gradually nearer to the insect's eye the reflex will come into view. The reflex appears as a disk having a fiery glow, in moths, and as a bright ruby spot in the cabbage butterfly. Sometimes six spots, surrounding a central spot, are seen in the eye of the insect; perhaps these are diffraction-images. A similar appearance is seen when the eye of this insect is observed by the naked eye, except that the spots are black. * * * The reflex seen with the micro-opthalmoscope is green in Tipula, and bright yellow in the diurnal flies. Colored diffraction-fringes are usually present around the central bright spot in both these insects; but the central image is sometimes surrounded by a perfectly black ring."

"The manner in which the luminous reflex scintilates is very suggestive of an alteration in the focal plane of the dioptric structures under the control of the insect."

The color of the reflex obtained is supposed to depend on the color of the fluid contents of the "spindle" ("Rhabdom" of Grenacher), while the reflex itself is due to reflection from the spindles, which, in moths, are surrounded by very close parallel tracheal vessels, which form a very perfect reflector.

The reflex disappears very quickly even in diffused daylight,

[1] Auge der Gliederthiere, p. 41.

[2] Die Sehorgane der Thierē, p. 205, 1885.

[3] Trans. Linn. Soc. Lond. Second Ser., Zoology. Vol. II. Part 2, p. 406–7. Dec., 1884.

but can be restored by keeping the insect in the dark for half an hour. The disappearance of the reflex in the light is due to the contraction of the pigmented iris cells.

METHOD OF ISOLATING THE DIOPTRIC LAYERS OF THE COMPOUND EYE.—Gottsche[1] was the first who succeeded in isolating the whole dioptric portion of the compound eye, so that the corneal facets and the cones could be examined *in situ*. The isolation of the corneal layer alone is more easily effected; this had already been accomplished by Leeuwenhoek, Baker, Brants and Gruel, who examined with the microscope the images produced by the corneal facets.

Gottsche took the eye of a fly, and separated the inner wall, so that only the cornea with the optical apparatus remained. Holding the cornea fast by one end, he next removed the red portion of the eye, *i. e.*, the retinulæ. These break off at the inner ends of the cones, leaving the cornea with the cones intact. The preparation is next laid on a slide with the convex side of the cornea down (there should be just glycerine enough beneath the cornea to make it adhere to the slide). A cover-glass is then placed over the preparation, with care to leave the concave upper side filled with an air-bubble. Slight pressure on the cover-glass will usually be found sufficient to create the air-bubble. If no undue pressure has injured the cones, the preparation is now ready for examination with the microscope. The tube of the microscope may now be placed so that the hexagonal facets are in focus, and then raised until the inner (upper) ends of the cones become visible, but not sharply focused. If any object, *e.g.*, a steel pen, is now held between the mirror and the preparation, a minute inverted image of the same will be seen in each facet.

Grenacher thinks the contents of the cones ("pseudocones") would escape by Gottsche's method, so that the experiment would really amount to no more than that of Leeuwenhoek, Baker, &c.

Grenacher (Das Sehorgan d. Thiere, p. 148), taking the eye of acrepuscular or nocturnal mòth that had been hardened in alcohol, cuts off a section with a sharp knife, places it on a slide with the convex corneal surface below, and then removes the pigment by a careful use of nitric acid. With this preparation he repeats the experiment of Gottsche, and finds that the images fall not behind nor in the ends, but near the middle of the crystal cones. This position of the images, at points where there are no percipient elements, is held by Grenacher to be fatal to the view that they are seen by the insect. According to Lowne's[2] view, the retinulæ constitute a second refractive system which serves to magnify and erect the images formed within the cones, so that the whole visual field consists of a mosaic of erect images.

[1] Mül. Arch., 1852, p. 488, 489.

[2] Trans. Linn. Soc. Lond., p. 389. Dec., 1884.

He places the retina behind the basilar membrane, precisely where it was supposed to be by Gottsche.

THE SAC-LIKE NATURE OF THE WINGS OF INSECTS.[1]—Mr. G. Dimmock showed the two halves of a split wing of *Attacus cecropia*, in which the two layers of the wing had been separated by the following mode: The wing from a specimen that has never been dried is put first into seventy per cent alcohol, then into absolute alcohol, and from the latter, after a few days' immersion, into turpentine. After remaining a day or two in turpentine, the specimen is plunged suddenly into hot water, when the conversion of the turpentine into vapor between the two layers of the wings so far separates these layers that they can be easily parted and mounted in the usual way as microscopical preparations on a slide.

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SCIENTIFIC NEWS.

—No glaciers exist in the United States but those of the Pacific coast, as only here the atmospheric conditions are favorable, and the ice-streams of Mt. Hood are the only ones on this coast easily reached. Down far below the snow line, great seas of ice push their way through valleys they have cut for themselves. Their downward motion varying in speed with the slope of the channel and the weight of snow above, is constant—a few inches a day. The lower part is ice, higher, icy-snow; and where there is little thaw, pure snow. The fields of the ice are strewn with unassorted debris, from bowlders weighing tons, to the finest sand which falls from the walls of the glacier valley. Near the foot of the glacier the rubbish is twelve inches or more thick, while in other places one can walk over nearly bare ice—aye, can travel for miles and study moraines, crevasses, ice wells, caves, ice tables and all the appurtenances of a first-class glacier without guide or alpenstock, ropes, or spiked shoes. The ice moves as only ice can, moulding itself to variations in the channel, and splitting across to form crevasses only when meeting some great descent in the bed. Melting extends up over the surface as well as at the base; the traveler steps across streamlets flowing upon the ice surface toward the base, perhaps to lose themselves in crevasses further down; and from the wedge-shaped snout of the ice giant pours a deluge of water, while down its face rains a shower of sand and rocks. The water assorts the debris, soon dropping the bowlders, carrying the coarse sand further, and bearing to the Columbia much of the ashy sand that is filed off by the bottom of the glacier.—*Portland Oregonian.*

— Professor W. A. Rogers, of the Harvard Observatory, has reported to the American Academy of Arts and Sciences, in Bos-

[1] G. Dimmock, Pysche, May, 1884, p. 170.

ton, the results of his observations on the transmission of shock from the Flood rock explosion.

The air-line distance between the observatory in Cambridge and Flood rock is 190 miles, and the observations were timed as follows: Disturbance first seen, 11.17.14; instant of maximum disturbance, 11.18.03; disturbance ceased, 11.20.

The first vibration perceived was about a thousandth of an inch, and recurred at intervals for nearly two minutes, the greatest swaying of the mercury being over a space of one five-hundredth of an inch.

In this connection it is interesting to note that General Abbot reported that the shock from 50,000 pounds of dynamite, exploded in 1876 at Hallet's Point, was transmitted through the drift formation of Long Island, at the rate of 5300 feet per second for 13½ miles. Assuming the figures of the Cambridge report as correct, and that the mine at Flood rock was exploded at 11.14, seventy-fifth meridian time, it took the wave just 194 seconds to travel 190 miles, or at the rate of 5120 feet per second. This is very near the rate of transmission observed by General Abbot, when the greatly increased distance is taken into account.—*Exchange.*

— While M. Pasteur, at his country retreat, has been developing a means of combating the spread of hydrophobia, alarmist notes have been sounded in the public press. There can be no doubt that hydrophobia is on the increase, and will continue to increase until the owners of dogs are sufficiently educated to recognize the preliminary symptoms of rabies. A dog that slobbers with hanging jaws, and barks unnaturally, should be destroyed. Dumb rabies is the most dangerous, perhaps, because the animal, while retaining a knowledge of his master and friends, is apt to be snappish, and bite without warning. Cauterization of such wounds is practically of little value, and the best thing that can be done is to suck the wound forcibly, so as to draw as much blood and fluid from the part as possible. At Monday's sitting of the Paris Academy of Sciences, M. Pasteur read a long paper on this subject, and furnished proofs that his methods of inoculation had cured hydrophobia, and was easily practicable. Dr. Vulpian corroborated, from personal observation.—*English Mechanic.*

— The second division of the Zoölogischer Jahresbericht für 1884, edited by the zoölogical station at Naples, and now published at Berlin by R. Friedländer & John, has appeared and is devoted to the Arthropoda. It can be purchased separately, as can the other three parts. The present part is edited by Drs. Mayer and Giesbrecht.

— Carl von Gumppenberg, of Munich, is preparing a monograph of the geometrid moths of the northern hemisphere, and would like to receive from American entomologists copies of their papers containing descriptions of new species of this group issued since the publication, in 1876, of Packard's monograph of American geometrids.

— The lecture course of the New York Academy of Sciences opened on December 14th, by a lecture on the genealogy of the Mammalia by Professor E. D. Cope. The next lecture will be January 11th, 1886, by Professor E. S. Morse, on Prehistoric Man in America.

— Professor Joseph Prestwich has a treatise on geology in the Clarendon Press. He advocates non-uniformitarian views of geology.

— Professor H. Weyenburgh died at Haarlem, July 25. He was professor of zoölogy in the university of Cordova, Argentine republic. He did a great deal for progress in his science, and of a set of thorough-going entomologists in that country he was chief.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

The International Geological Congress, at Berlin, Sept. 29th to Oct. 3, 1885.—The third and most important session of the International Geological Congress, which was instituted by an American committee of the A. A. A. S., at its Buffalo meeting in 1876, has just been held.

The first session at Paris, in 1878, was really a *pourparler* which broke ground. The next session at Bologna, in 1881, accomplished something, but was especially useful in preparing for the work of the session just closed by deciding to produce a geological map of Europe on a scale of $\frac{1}{1500000}$, and entrusting its execution to one committee, while another was appointed to devise some scheme for unifying the nomenclature and, where possible, of fixing the limits of various congeries of beds which had heretofore been differently understood by different geologists. The obstacles which faced these committees will be at once understood from this bare statement and will modify any hasty impression that, in fact, very little has been accomplished.

The two committees, or a majority of members of each, met at Foix, and at Zurich, during the four years which intervened between the Congresses of Bologna and Berlin, and the action of the congress which has just ended was almost exclusively confined to the propositions made in the printed reports of these committees.

Those who arrived in Berlin some days before the opening of the congress found, at the superb Bergakademie on the Invaliden strasse, a bureau organized to examine the credentials of delegates and provide each with the necessary card and receipt for the ten marks cotisation, besides a medal in silver bearing the inscription on one side: "Geologorum Conventus. Mente et Malleo," with the conventional schlägel und eisen crossed and surrounded by a wreath of oak. On the other side, within a similar wreath were the words: "Berlin, 1885." The medal was suspended by a white satin ribbon and worn on the lapel of the coat for identification on excursions, etc.

A programme of the order of events may be thus condensed: Monday, Sept. 28, at 10 A. M., meeting of the council at the Reichstagsgebäude; 5 P. M. social reunion of the members of the congress in the ante-chamber of this palace. Tuesday, Sept. 29, 11 A. M., opening of the congress; 2 P. M., visit to the Bergakademie to view the collections and the objects sent to the congress. Wednesday, Thursday, Friday and Saturday, sitting of the congress at 2 P. M. 7 P. M. Saturday, close of the congress. Sunday, 9 A. M. excursion to Potsdam. Then followed announcements of the excursions to the Hartz, to Stassfurt, etc. This programme was followed in the main, only an extra session of the congress being intercalated. The usual course was to devote two hours to the discussion of the committees' reports (2 to 4 P. M.), and the last two hours (4 to 6 P. M.) to scientific discourses of various delegates.

The weather during the entire week was very disagreeable, cold and rainy. On Sunday morning after the close of the congress, it promised to be fair, but only to deceive the hopes of those who took part in the Potsdam excursion. The commencement of this trip was very beautiful, but towards the close it degenerated into a procession of dripping and shivering people who tried to look as if it were pleasant in order not to offend their kind hosts.

The language of the congress had been decided upon as French, and this, no doubt, accounts for the greater share taken by the Swiss, Belgians, and French in the debates, than by the people of other nationalities. The Germans, for instance, who outnumbered all other nationalities taken together several times over, had only one representative who managed the language with fluency and led in debate—M. Hauchecorne, the active spirit of this congress. It is true that M. Neumayer retorted very effectively once to M. Lapparent, and his excellency v. Dechen spoke frequently, if not easily; but Dr. Beyrich, the nominal president, was entirely unintelligible, and M. Stur was obliged to get a dispensation from the congress and speak in German.

Report of Proceedings.—On Tuesday evening at 6 o'clock, M. Renevier, of Switzerland, the secretary of the committee appointed to prepare the European map, with a few preparatory words explaining that what he was about to read did not emanate from him but from the committee, presented this report.

The committee appointed to prepare the map was thus constituted: Beyrich and Hauchecorne (formerly the sub-committee of direction in Berlin), Germany; Daubrée, France; Giordano, Italy; de Mœller, Russia; Mojsisovics, Austro-Hungary; Topley, Great Britain; Renevier (secretary general), Switzerland. The committee of direction had made an arrangement with D. Reimer & Co., of Berlin, according to which this firm agreed to undertake the publication of the map at its own risk, provided the committee would guarantee them an edition of 900 copies at 100 francs a copy, and would advance them sums on account.

The map is to consist of forty-nine sheets—7 in breadth and 7 in height. Each of these sheets is 48 by 53 ^{cm} and the whole of them together will form a chart 3.36 meters high and 3.71 meters broad. Professor Kiepert, of Berlin, is to prepare the topographic base, using for the purpose all data at his disposition, both published and unpublished. Great Britain, France, Spain, Italy, Austro-Hungary, Germany, Scandinavia, and Russia, each takes 100 copies = 800. The remaining 100 copies are to be divided between the six smaller States, Belgium, Holland, Denmark, Switzerland, Portugal, and Roumania. The central committee is to receive from each national committee the maps of its country and to make them harmonize.

The report ends with the following six resolutions, which the committee asked the congress to pass:

I. M. Karpinski will succeed M. de Moeller (resigned), in representing Russia on the committee.

II. The *Carbonic* system (or Permo-carboniferous) shall be represented on the map by three distinct shades of gray.

III. Brown shades will be applied to the "*Devonic*."

IV. The color to represent the "*Siluric*" is left to the discretion of the committee.

V. The eruptive rocks shall be represented by seven tints ranging from bright red to dark-brownish red.

VI. The determination of the other questions mentioned in the report shall be left to the discretion of the committee.[1]

Proposition I was adopted without dissent.

Proposition II after much opposition was agreed to with the understanding that the proposed method of the committee should not be understood to have any bearing on the scientific settlement of the question, but should be regarded purely as a provisional expedient adopted in order to complete the map.

Proposition III was agreed to.

[1] The questions here referred to, comprise several matters about which the committee was in doubt, e. g.: *a.* How are the terranes to be represented, of which the subdivisions were doubtful? *b.* How are those subdivisions to be indicated which are too small to appear on the adopted scale of $\frac{1}{1500000}$? *c.* How are measures to be represented when even their age is doubtful? How represent subdivisions concerning the affiliations of which geologists differ (Gault, Rhetien, etc.).

Proposition IV, after strong opposition from Professor Hughes and M Jacquot, was finally so modified as to allow the committee to adopt it provisionally for the purposes of the map without prejudging abstract scientific questions at all, and thus carried.

Propositions V and VI were carried without objection.

Sept. 30, 1885, at 2.30 P. M., the congress reässembled to take action on the report of the committee on the unification of nomenclature which was then presented by M. Dewalque.

The reading of this report, which was much longer than the other, was taken up at p. 13, A.

The thirteen pages of the report thus skipped had been in the main adopted at the Bologna Congress, a few minor points having been left for future adjustment. They concerned for the most part definitions of terms such as "group," which it was advised should be applied to the division of the highest order (*e. g.* secondary *group*, etc.); the next division should be *systems* (Devonian *system*, etc.); the third should be *series* (*e. g.* the coal measures *series* of the Carboniferous system); the fourth division should be *stages* ("étages") (millstone grit, *stage*, etc.); the division of the fifth order was decided upon for French only, "*assise*" or "*couches*." "*Zone*" should be used for a number of beds having one or more fossils to characterize them, but it should be inferior as an order of classification to "*stage*." "*Bank*" was selected to imply a bed (couche or assise), thicker or more coherent than those in its vicinity, among which it is intercalated. These and certain conclusions as to the application of the terminations "ary," "ic," and "ian"—the first for the groups, the second for the series, and the third for the stages—completed the linguistic portion of the report. It is to be observed that no adjective termination to precede system was proposed.

The remainder of the report, unacted upon, concerned subjects partly implied in the later portions.

Archæan.—It was decided to give to the Pre-palæozoic rocks the name Archæan instead of Primitive, and while recognizing three divisions to allow each geologist to distinguish them by petrographic characters.

Silurian.—On the motion of Professor Archibald Geikie, the decision as to the limits of the Silurian and Devonian is left till the meeting of the congress in London in 1888, but the committee on the chart has liberty to divide the lower system of the Palæozoic group into three parts of which the names will be determined upon later.

Devonian.—After a long and exciting discussion, it was proposed: *a.* That the Devonian should be divided into three parts corresponding respectively with those termed the Rhenan, the Eifelian, and the Famennian. *b.* That the calceola beds should form part of the Eifelian. *c.* "That the upper limit of the Devonian should be drawn at the base of the Carboniferous limestone, that is to say, the system which includes the psammites of Condroz and the upper Old Red" [the words "the Lower Carboniferous (Kilborkan, Marwood, Pilton)" and "or the calciferous sandstone Dura Den" were stricken out of the committee's resolution at the request of Professor A. Geikie as not representing the real associations of these beds].

Carboniferous.—The question of associating the Permian with the Carboniferous provoked the most interesting discussion of the congress, Stur of Vienna, Lapparent, Blanford, and Professor Newberry spoke in favor of such union. Hughes, Topley, Nikitin, and a great many others spoke against the association. Professor Newberry in the course of his remarks, said that "his honored colleague, Professor Hall, was of the opinion that the Permian did not exist in America, and that his own studies confirmed this view." M. Neumayr thought "the decision of such questions as this should not depend upon a majority vote which would change in each country, and after each eloquent speaker (referring to M. Lapparent's brilliant defense of the committee's proposition). This view was finally taken, and the congress adopted, with about fifteen dissenting votes, the following proposition formulated by M. Dewalque:

"The congress not wishing to pronounce an opinion on the scientific question will leave the classification as it is."

Triassic.—After much debate the three-fold division of the Triassic was agreed to, but without giving names to the divisions.

Jurassic.—The division of this system into three was adopted, but without specifying the names of the divisions.

It was agreed that each geologist might draw the upper horizon of the lias where he thought best.

Cretaceous.—It was agreed that the Gault should be joined to the Cretaceous.

Tertiary.—The divergence of views on this subject was so great that M. Capellini then in the chair, cut short the whole question by asking for a vote of confidence in the committee, which was unanimously given.

Eruptives.—Finally the seven-fold division of the eruptive rocks, in as many tints of red, was carried without opposition.

This completed the serious geological work of the congress, and it was then agreed to meet in London in 1888. A committee consisting of Hughes, Geikie, Blanford and Topley was appointed to make the necessary arrangements, and the congress adjourned.

During the course of the congress addresses were given by M. Gaudry on certain reptiles; Newberry, on a new large Devonian fish from America; Posepuy, on the fluid condition of the earth's interior; Ochsenius (in German), on the origin of salt deposits; Neumayr, on the plan for the "nomenclator palæontologicus," which he is compiling (and which the congress voted to publish under its auspices and through the agency of a special committee consisting of MM. Gaudry, Zittel, and Neumayr); M. Nikitin presented his map of the Middle and Southeast Russia, including the valley of the Volga; M. Vasseur, thirteen sheets of the map of France; and Dr. Frazer, on behalf of Mr. McGee, presented an explanation of the methods employed by the director of the United States Geological Survey.

The delegation which represented the United States at this congress consisted of Professor James Hall and Professor J. S. Newberry, members of the original committee which suggested the congress; Professor D. Ph. H. S. Williams and Professor D. Sc. Persifor Frazer, who were elected by the American Association for the Advancement of Science at its Ann Arbor meeting. Besides this, Professor Brush was elected by the committee under the powers granted to it. Mr. J. F. Kemp (assistant to Professor Newberry), Mr. H. B. Patton (student), and Mr. H. E. Miller (chemist), from America, also appeared on the roll of the congress. The last two named were not known to the secretary, who cannot say whether or not they attended the sittings. Mr. McGee, representing Maj. Powell and the U. S Geological Survey, arrived after the sessions had commenced.—*From Science, Oct. 30, Persifor Frazer, Secretary of the American Committee delegates.*

[*Note.*—A more detailed report, giving the debates in part, will appear shortly in the *Am. Journ. of Sci. and Arts.* In *Science* for Dec. 11, Professor Dewalque does not agree as to the action on paragraph *C. c.* under the Devonian. I am sorry not to feel authorized to change it. Several members of the congress think that the action was as above stated.—*P. F., Dec. 15, 1885.*]

National Academy of Sciences, Albany, Nov. 10–12, 1885.—The following papers were presented: Obscure heat, by S. P. Langley; A new form of craniaphore, for taking composite photographs, by John S. Billings; The carboniferous xiphosuran fauna of America, by A. S. Packard; Stellar photography, by E. C. Pickering; Two new forms of polyodont and gonorhynchid fishes, from the Eocene of the Rocky mountains, by E. D. Cope; Yale College Observatory, New lines on the spectra of certain stars, by O. T. Sherman (by invitation); Certain stars observed by Flamsteed, and supposed to have disappeared, by C. H. F. Peters; Remarks upon the international geographical congress at Berlin, with a brief historical notice of the origin of the congress, by James Hall; Notes on some points in the geology of the Mohawk valley, by James Hall; When shall the astronomical day begin? by Simon Newcomb; Primordial rocks among the Waffinger valley limestones near Poughkeepsie, N. Y., by William B. Dwight (by invitation); The errors of star catalogues, by C. H. F. Peters; Preliminary report on the investigation relating to hereditary deafness, by A. Graham Bell; The new star in the nebula of Andromeda, by C. A. Young; Recent progress in economic entomology, by J. A. Lintner (by invitation); Remarks on the stone ruins of the Colorado and the Rio Grande, by J. W. Powell;

The New York State herbarium, by Charles H. Peck (by invitation); The formation of a polar catalogue of stars, by T. H. Safford (by invitation); A section through the southern tertiaries, by Otto Meyer (by invitation); Remarks upon the Lamellibranchiate fauna of the Devonian rocks of the State of New York, and the results of investigations made for the palæontology of the State, by James Hall; Recent discoveries of gigantic placoderm fishes in the Devonian rocks of Ohio, by J. S. Newberry; The flora of the Cretaceous clays of New Jersey, by J. S. Newberry.

Academy of Sciences of Indiana.—The preliminary circular proposing the formation of a State Academy of Science of Indiana, issued by authority of the Brookville Society of Natural History, has elicited such a general response in favor of the movement that there has been issued a circular calling a meeting of all of the people of Indiana interested, to be held in the criminal court room (Hall of Representatives) of the Marion county court house, at Indianapolis, Ind., on Tuesday, December 29, 1885, at 2 o'clock P. M.

In order that a proper understanding may be had of the present state of scientific study in Indiana, it has been thought advisable to ask from competent authority a statement of the present condition of each branch of science that is being studied within the borders of our State. The following persons have kindly consented to present papers upon the several subjects mentioned.

Richard Owen, M.D., Sketch of the work accomplished for Natural and Physical Science in Indiana; David S. Jordan, M.D., Icthyology; Professor John M. Coulter, Botany; Professor J. P. Naylor, Physics; R. T. Brown, M. D., Geology; Professor O. P. Jenkins, Lower Invertebrates; E. R. Quick, Mammalogy; Professor Robert B. Warder, Chemistry; Professor O. P. Hay, Herpetology; Daniel Kirkwood, LL.D., Astronomy; P. S. Baker, M.D., Entomology; Maurice Thompson, Mineralogy; Rev. D. R. Moore, Conchology; Sergeant Orin Parker, Meteorology; J. B. Conner, Statistics; A. W. Butler, Ornithology.

New York Academy of Sciences, Nov. 9.—The following paper was presented: Description of some gigantic placoderm fishes recently discovered in the Devonian of Ohio (with illustrations), by Dr. J. S. Newberry.

Nov. 16.—The following paper was read: The rise and progress of invertebrate Zoölogy, by Dr. J. B. Holder.

Nov. 23.—The following paper was read: The preservation of building materials by the application of paraffine, as recently used upon the obelisk (illustrated with apparatus and experiments), by Mr. R. M. Caffall.

Nov. 30.—The following papers were presented: On meteoric irons (1. From Glorieta mountain, Santa Fé county, New Mexico; 2. From Jenny's Creek, Wayne county, West Va.), by Mr. Geo. F. Kunz; Minerals of Harlem and vicinity, by Mr. B. B. Chamberlin.

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THE POST-MORTEM IMBIBITION OF POISONS.

BY GEORGE B. MILLER, M.D.[1]

THE subject is one not only of a highly interesting character to the scientific observer, but also an important one from its medico-legal aspects. Perhaps the questions which very naturally first arise, viz., What is its nature and what are its medico-legal relations? can be best answered by the following hypothetical case, which it is hoped will serve to illustrate the subject in a manner best calculated to aid in its thorough comprehension.

Suppose a person dies of a natural cause, and is buried in the usual manner in conformity with the established customs of his country, the body to all external appearances not having been tampered with. Also, that, after the lapse of a few weeks, an individual who had previously introduced into the body, per mouth or rectum, a poison or poisonous solution for the purpose of accusing an innocent person of a horrible crime, should quietly circulate a report that the deceased had been poisoned, and intimate that the crime had been committed by such and such a person. With what remarkable lightning rapidity does a report of such a sensational character as this travel from one individual to another, rarely ever finding the doors barred, the contrary being the rule! This report would in a short space of time reach the tribunal of justice, cognizance would be manifested by the proper authorities, who would order the body to be exhumed, the various organs removed and given in charge of a reliable expert, who would subject them to a chemical analysis, which

[1] Inaugural thesis presented to the Faculty of the Medical Department, University of Pennsylvania, A. D. 1885.

would reveal the presence of the suspected poison. The subject is not of very recent date as many are led to suppose from the meagre account given, if given at all, in some of the standard text books on toxicology of the present day. As far back as the time of Orfila, when he swayed as chief of the toxicologists, was the subject known, and indeed it appears that almost cotemporaneous with the birth of toxicology, already an account of the subject appeared.

In order to see in what light the subject was regarded in former times, extracts from the writings of a few authors will be here made, as to go over them all would involve a great amount of unnecessary labor. How eloquent is the language of Orfila on the subject, and in what an exceedingly small number of words does he illustrate the whole subject (Orfila on Poisons). He writes: "Suppose some wretch, with the design of accusing an innocent person of the crime of poisoning, should introduce into the digestive canal of a dead body a poisonous solution, which would afterwards penetrate by imbibition even to the remotest organ from which it would be subsequently extracted by the experts, and would lead them to the conclusion that they were dealing with a veritable case of poisoning." From the following it will be readily seen that the celebrated chemist, Sir Robert Christison, although not in possession of any evidence of crime having been practiced, yet was fully aware of the circumstances under which it might perchance be committed. Says Christison: "Although I have never been able to find any authentic instance of so horrible an act of ingenuity having been perpetrated, it must nevertheless be allowed to be quite possible."

The realization of the greatness of the crime does not seem to be apparent to the wretch who is meditating the commission of it, brooding over the insults of another, and holding malice against a fellow-man or especially (as it affords a better chance for the full performance of his crime), against one of his relatives, and ravenously seeking retaliation; for if it was realized, how is it possible that an individual, capable of the perception of right and wrong, living in society, constituting a part thereof, mutually dependent on and coöperative with his neighbor, could use such means for the wicked furtherance of his ends?

That there have existed in times past among the communities of the civilized nations of the world, individuals who have harbored such hatred toward their fellow-men that they have not faltered in carrying their intentions into practice, is manifested by the defences set forth in the trials of various murder cases, which are recorded in the annals of the tribunals of justice, not only of the New but also of the Old World.

That in a number of murder cases the defence has been that the poison was designedly introduced into the dead body for the purpose of crimination is made apparent by the narration of the following cases: Professor John J. Reese, M.D., in his article on the Post-Mortem Imbibition of Poisons (Transactions of the College of Physicians and Surgeons, 1877), relates a remarkable case of alleged arsenical poisoning, which occurred in one of the Western States. The suspicions were exceedingly strong that the poison was introduced after death for various reasons. The old man having been treated in his last illness for phthisis, his physician testifying to his having died of this disease, and to his having presented no symptoms of arsenical poisoning before death.

The body was buried four (4) years, during which time no suspicion of foul play appears to have been entertained. In the meantime, the widow again married, and the suspicion of poisoning was bruited about. The woman was accused of the crime, the body was exhumed, and a chemical analysis revealed the presence of this poison in the stomach and liver.

The defence was that the poison was designedly introduced into the body not very long before the disinterment, the body being kept in a vault. The case, singularly enough, having had a preliminary hearing, was abandoned.

Illustrative of the same, we have an article by Dr. Victor C. Vaughan (physician and surgeon, Ann Arbor, Michigan, Aug. 1883): "During the past six months there has been tried in this State a murder case, in which the question arose whether arsenious oxide could diffuse after death, after it had been mixed with water, and injected into the rectum or mouth or both."

Since direct experiments by others, and by the author himself, as will be seen hereafter, seem to prove that the absorption of poisons after death does take place, it must necessarily become an important factor how in such cases to differentiate ante-mortem from post-mortem poisoning. The methods are very limited. Perhaps the most reliable as well as the most conclusive evidence of ante-mortem poisoning are the symptoms manifested by the patient before death. Of little less importance is the revealing of the presence of the poison by chemical analysis in the interior of a large organ, as for instance, the liver; since it does not appear to be likely that a poison introduced after death could penetrate by imbibition even to the interior of so large an organ. That Professor Reese attaches much importance to the detection of the poison within organs will become evident by the following extract from the article before mentioned. Says Professor Reese: "If the poison were found on the exterior of the organs only, and not in their interior, after a careful research, I should regard it as a true case of 'Post-Mortem Imbibition.'"

In this connection a digression may be allowable relative to the impregnation of a dead body from arsenical soil into which it is sometimes unfortunately placed. In those cases, where owing to suspicions of poisoning it becomes neçessary to disinter a body for legal purposes, it is often found that the coffin in which the remains are deposited has burst open, thus allowing the contents to come in contact and mingle with the soil (which in some rare instances contains arsenic). At the trial of these cases the counsel for the defendant, hard pushed for a defence, and whose only resource lies in a choice between "insanity" and "arsenical impregnation from the soil," in some cases selects the latter. The actions of lawyers in setting forth such groundless defences, being cognizant of the impossibility of the transudation taking place, and living in the light of present scientific knowledge, might be looked upon as of doubtful propriety. Unfortunately, in order to show that such a course is frequently pursued, it is only necessary to search the actions taken by the Commonwealth in the trial of cases of this nature, when it will be found that along with a chemical analysis of the organs, there is made also a chemical analysis of the soil. Indeed, this mode of action was taken in a recent case of arsenical poisoning occurring in this city (Philadelphia), in which the prisoner, although twice convicted, has not as yet been sentenced, on account of the existence of some of the so-called "technicalities." From the following opinions of certain toxicologists who have made it a study, it will be seen that it is regarded as impossible for this contamination to take place.

Professor Reese (Proceedings of College of Physicians and

Surgeons, 1877) says: "In the few cases in which arsenic has been discovered in cemetery soils, it has invariably existed in the insoluble state generally in combination with either lime or iron. Indeed, it cannot be extracted from such soils even by boiling water, but the agency of hydrochloric acid is required to render it soluble; consequently, it is impossible that arsenic should be capable of transudation from the soil into a dead body."

This assertion is corroborated by the direct experiments of Orfila (Acad. of Med., June 29, 1847), who showed that bodies buried in arsenical earth for a period of three (3) months, did not acquire any arsenical impregnation from arsenical soil. But even admitting that it is possible for a body to become impregnated from arsenical soil, it could be easily determined in case a body contained arsenic, whether it derived the poison by contamination with earth, or whether the poison was introduced into the body; by taking two samples of earth, one from the immediate contact with the coffin, and the other from the same strata, but in an adjacent portion of the cemetery, and subjecting both to a chemical analysis; if the analysis revealed the poison in the coffin soil, and not in the adjacent soil, then it would be evident that the soil was contaminated by the body and not the body by the soil.

With a view of determining whether it is possible for a poison introduced into a dead body, to penetrate through the various organs, and be recovered by chemical analysis, a series of experiments were conducted.

A small dog was killed, and into the stomach was introduced, by means of a flexible catheter, two ounces of water containing twenty grains of arsenious oxide. The animal was placed in a pine box, buried, and at the expiration of sixty days was exhumed. The following organs, viz., the stomach, liver, kidneys, lungs, heart and brain, were then removed. On the surface of the organs were observed brownish-black spots. The organs were found to be in a remarkable state of preservation, especially the kidneys. The brain was only slightly broken down, but the dura mater was intact. A bright yellow spot of the size of a small pea was observed on the urinary bladder.

The organs removed were placed in separate glass jars, and then subjected to a chemical analysis. The process employed for the recovery of the arsenic being the "Frenious and Babo" or the hydrochloric acid and potassium-chlorate method, with the purification method of Otto. These are as follows: "The organ is cut into small pieces, and hydrochloric acid and water added. The mass is heated to near but not quite the boiling point on a sand bath. Potassium chlorate is added, in portions, the mass being stirred continually. The chlorine evolved disintegrates the organic matter. The mass is stirred and heated until all the chlorine is driven off, and it becomes homogeneous. The volume is kept up by adding water. Allow to cool and transfer to a moist linen strainer, and strain until the filtrate is clear, restraining all that is turbid. The residue is washed well with water. The arsenious oxide has been oxidized by the potassium chlorate to arsenic oxide. Reduce to arsenious oxide by adding an excess of a solution of sulphurous acid gas, the excess of gas being known by the odor.

The mass is evaporated to twice the volume of hydrochloric acid used; cool and filter if necessary. Thoroughly saturate while warm with a washed stream of sulphuretted hydrogen, which will throw down the arsenious oxide, organic matter, sulphur and the sulphides of other metals. Filter, wash the residue until the washings are free from chlorine. The residue is washed with a few c. c. of water containing ammonium hydrate. The sulphide of arsenic will be dissolved by the ammonia water and pass through. Evaporate to dryness in a water-bath, and add a few drops of nitric acid to destroy the organic matter; the nitric acid will also oxidize the sulphide of arsenic to arsenic oxide. Evaporate to dryness and repeat until the mass has a yellow color. To the dry residue add a small quantity of a solution of potassium hydrate and powdered carbonate of soda, and evaporate again. The potassium hydrate will combine with the arsenic oxide, forming potassium arsenate. Evaporate to dryness, and add three or four drops of concentrated sulphuric acid. Heat on naked flame until vapors of sulphuric acid cease to arise. The sulphuric acid will clear the organic matter. Pulverize the residue if necessary, add 25 c. c. of water, and one drop of sulphuric acid to acidulate. Boil and filter. The filtrate which contains arsenic oxide should be *colorless*. Reduce arsenic oxide to arsenious oxide by an excess of a solution of sulphurous acid. Concentrate until all of the sulphurous acid is gone, and about 20 c. c. remain.

The reagents employed in the extraction of arsenic, themselves frequently contain this substance, notably those of zinc and sulphuric acid; hence, it becomes necessary to test all reagents to determine that they are absolutely free from this poison. None but "chemically pure" reagents were employed, the sulphuric acid being found to be such after subjecting it to Marsh's test. On the application of Reinsch's test to the hydrochloric acid and copper foil, they also proved to be reliable. *Summary of results obtained by chemical analysis of the organs removed from dog containing arsenic:* The extracts obtained from the stomach, liver, kidneys, lungs, heart and *brain* were subjected to Reinsch's test, and from *all of these organs arsenic* was recovered. In each case a sublimate was obtained on the side of the reduction tube, which, placed under the microscope, revealed the presence of arsenic by exhibiting many beautifully formed octohedral crystals. It should be remarked that the results obtained from the examination of these organs were about equally striking, with the exception of the brain, which gave somewhat less marked reactions.

On examining the literature of the subject of the "Post-mortem imbibition of poisons," it will become apparent that it has not received the amount of attention it so justly deserves. Indeed, so far as the writer has been able to learn the only investigations pertaining to the subject are those of Drs. Victor C. Vaughn, Kedzie and George McCracken.

Dr. Vaughn in the first of his experiments (physician and surgeon, Ann Arbor, Michigan, August, 1883), used a musk-rat, injecting into the mouth and rectum by means of a syringe fifty (50) grains of arsenious acid suspended in cold water. The rat was buried twenty-five (25) days, and the organs subjected to a chemical analysis, which revealed the presence of this poison in the kidneys, liver, lungs, stomach and contents, large intestine, small intestine, heart and brain. In his second experiment a cadaver was used, an unweighed quantity of arsenious oxide was introduced into the mouth and rectum, the body being then placed in a cellar for twenty-five (25) days. The brain was broken down, and in a semi-fluid condition, the rest of the organs firm. Chemical analysis revealed the poison in the right and left kidney, liver, lower lobe of right lung, heart, rectum, spleen, stomach and brain.

Dr. Kedzie, of the Michigan Agricultural College, working independently, made experiments on a cat with like results. In again referring to the results of the experiments by the writer, it will be seen that arsenic was recovered from the *brain* of the animal into which this poison had been introduced. The fact that a poison, introduced after death, can penetrate through the various tissues and saturate the great nerve centers, protected and surrounded as they are by a bony casing, must be looked upon as an astonishing as well as an interesting fact. Upon this point Dr. Reese (Transactions of College of Physicians and Surgeons, 1877), observes: "It is scarcely conceivable that a poison introduced into a body after death could penetrate by imbibition within the cavity of the cranium and spinal cord."

In the experiments of Dr. Vaughn, the following explanation is offered for having found arsenic in the brain, viz., "In injecting the solution into the mouth, the syringe used clogged up, and on attempting to force it free, a portion of the fluid was observed to flow from the nostrils, some of this fluid probably adhered to the pharynx."

In the writer's experiments, when the dog employed was being placed in the box, a small amount of fluid was observed to trickle from the nostrils. Whether the presence of arsenic in the brain was due to the foregoing accident or not is uncertain. In a series of experiments on "Post-Mortem Imbibition of Poisons," Dr. Geo. McCracken introduced the three poisons, viz., arsenic, tartar emetic and corrosive sublimate, and subsequently recovered them by chemical analysis from several organs.

Though always allowable, it is not our purpose to attempt to draw positive deductions from the facts adduced, but rather to allow our own results, which have been gained by a strictly scientific process, *to speak for themselves.* In conclusion, however, it may be remarked that the hypothesis that arsenic through the process of post-mortem imbibition from the alimentary canal is, by careful chemical analysis, discoverable in the brain, *receives* entire confirmation from the present researches.

ASCENT OF THE VOLCANO OF POPOCATEPETL.

BY A. S. PACKARD.

THIS famous volcano, called Popocatepetl from the Aztec *popoca*, smoking, and *tepetl*, mountain, was the objective point of my journey to the Mexican plateau. The Nevada de Toluca I had seen a few days previous from the town of Toluca, on the Mexican National Railway. This volcano, however, is not a simple conical peak, but its snow-covered dome rises 15,156 feet above the sea, and out of a mountain mass with four lesser elevations about it. From Toluca the crater is seen to be a very large one, and we were told that it is 1500 feet deep with a lake at the bottom said to be two and a half miles across.

Orizaba we were yet to see; but nothing could, we thought, exceed in interest the distant view of Popocatepetl from the top of our hotel in the City of Mexico, as the setting sun gilded its snowy dome, and as it went down painted its snow fields with roseate hues. It is the grandest mountain summit of the valley of Anahuac. It repeats, but with emphasis, the purity of form and massiveness of Mt. Shasta, in Northern California. Its twin sister, the volcano of Iztacihuatl, or the "snowy woman," forms a part of the same isolated range—the Cordillera of Ahualco—and was doubtless thrown up at the same time; but it has no central dome cleaving the sky, the mountain mass extending as a range running nearly north and south, with three broken irregular snow-covered summits, of which the central is the highest, reaching an altitude of 4786 meters or 15,705 feet above the sea. The height of Popocatepetl has been variously estimated. Humboldt placed it at 5400 meters, or 17,716 feet; Guyot gives its altitude as 17,784 feet; Humboldt's measurement combined with those of two later observers, is 17,853 feet, while the French savans of the Maximilian expedition put it as high as 18,362 feet. The height of the City of Mexico above the sea is 7482 feet, so that we had before us an ascent of a little over 10,000 feet. This is nearly 2000 feet less of an ascent than that of Mt. Shasta, which is 14,442 feet high, while the plain out of which the California volcano rises is about 2000 feet above the sea.

For two days previous to starting we were occupied in arranging for the ascent. Our party consisted of three. Mr. F. A. Ober, author of the interesting Travels in Mexico, who had previously made the ascent, kindly accompanied us to the snow line as guide, interpreter and friend.[1] We laid in supplies of boiled chicken, other meats, bread and tea for our night at the ranch and the noon lunch on the summit. By the kindness of Messrs. D. S. Spaulding & Co., I obtained a letter from General Gaspar Sanchez Ochoa, the proprietor of the mountain, to one of his employés, Sr. D. Mariano Mendizabal, at Amecameca, who was ordered to send his son Rafael to guide us to the summit. The day previous to leaving the City of Mexico I telegraphed to Senior Norriega, a grocer at Amecameca, for horses and guides for a party of four. That evening the sun sat clear on Popocatepetl, and the weather promised to be clear and fine on the morrow.

On the morning of March 19th, after an early breakfast, we drove to the railroad station at San Lazaro, leaving it at 8 A. M. The sky was a little overcast, but soon the sun came out clear and hot. We soon crossed the edge of Lake Tescuco over a causeway, along the canals traversed by Indian dugouts, over the shallow reedy lake, in which were men and boys naked or stripped to the knees, wading through the water, fishing in its shallow depths with nets for shiners or axolotls. The track then leaves the lake and its flaggy, reedy shores and passes over a broad dry plain, the ancient bottom of Tescuco, the western portions of which are said, by Humboldt, to have been covered with water in 1521. Here were to be seen the mounds of that busy ant, *Pogonomyrmex occidentalis*, so familiar a sight from Montana to New Mexico and from Kansas to Reno, Nevada.

At the first station of Equipajes we get a fine view of Popocatepetl and Iztacihuatl. The railroad then skirts the borders of Lake Chalco, and we see upon our right many of the famous floating islands covered with green flags and reeds, which had survived since the time of Cortez. At the station of Ayotla the Indians crowd about the train offering fishes wrapped in the leaves of the pond lily, and here we bought half a dozen large axolotls for a cent apiece. We then passed within sight of Chalco, the oldest Indian town of the valley of Anahuac. Amecameca, the town where we take our guides and horses, is about forty miles by rail from Mexico and 1274 toises or 8223 feet above the sea. It is the highest town in Mexico; its elevation renders

[1] The two others were Professor J. W. P. Jenks, of Brown University, and Hon. Titus Sheard.

it more salubrious and cooler than Mexico, being nearly 600 feet higher than that city, and it is somewhat frequented by invalids from the city in hot weather. Before reaching the town, however, we pass through foothills covered with a growth of pines and oaks, with an intermixture of maguey or century plants under cultivation. The scenery now becomes very grand as we skirt along the ranges—from four to six—which are parallel with Iztacihuatl. At 10 A. M. both volcanic peaks were enveloped in cumulus clouds, but they rolled away from the mountain of the "white woman," still, however, obscuring the snow-clad dome of Popocatepetl. The massive base of Iztacihuatl below the clouds was seen to be studded with conical peaks, any one of which would be a prize in Maine or New Hampshire. As the train stops at Amecameca we pass the hill of Sacramonte, covered with a dense growth of noble cedars and pines surrounding the chapel on the summit, and enter the railroad hotel at eleven o'clock for dinner, first, however, regaling ourselves with the full and superb view of Popocatepetl and its sister volcano, whose serene heights now clear and well-nigh cloudless, looked down upon the town spread out over the valley at their feet.

After dinner we met our guide Rafael with his men, horses and pack mules at the grocery store of Señor Francisco Norriega, where we laid in additional provisions, and punctually at one o'clock started for our camp at the base of the peak. Our party consisted in all of seven horsemen, with two pack mules and three mozos or *guias* on foot. A *guia* is an assistant guide, usually an Indian servant or *mozo*. For the benefit of any one intending to make the ascent, I give in a foot-note[1] the particulars of our outfit of guides, servants, etc., with the prices, being a copy of the items in Rafael's bill.

[1] 4 horses at $2.00 a day	$16 00
3 guias at $2.00	12 00
2 mules at $1.50	6 00
1 barley for the horses and mules	1 75
6 pieces of leather for making sandals	1 31
8 straw mats	1 50
8 leather thongs	50
8 yards of cloth for wrapping the feet	1 75
Thread, etc.	25
A mozo to look after the horses at $3.00 a day	6 00
Rafael Mendizabal	10 00
	$57 06

We were urged to discard our shoes and let the guias wrap our stockinged feet in rags with a pair of rough leather sandals, but we preferred to wear over woolen stockings our ordinary high shoes and over the latter a pair of arctics, and found that they answered the purpose admirably in walking over the soft snow and yielding sand of the peak, while our feet did not suffer from the piercing cold winds of the early morning hours. We had provided ourselves at Mexico with a pair of native blankets for the bivouac at the ranch. Thick gloves are also needed, while blue-glass goggles, which most of the party bought at Norriega's, are absolutely indispensable. It is impossible to walk over the snow fields of Popocatepetl in the glaring sunshine without them. I carried and tried to use a pair of colored eye-glasses, but they would slip off while walking, and proved a source of constant annoyance until my *guia* changed with me, and considerately made the best use he could of my glasses.

The charges of the guide Rafael were fair, but we could have dispensed with the Spanish assistant guide and the mozo to attend the horses. The *guias*, or sub-guides, were Indians, nearly or quite full-blooded, and were strong, faithful young men. They expected and received besides their regular pay a gratuity for their services. Were I to make the ascent again alone, a good *mozo* besides the guide would be indispensable. No one should attempt to ascend the mountain alone without such attendance, as some accident might happen on account of the altitude, though there is no dangerous climbing. We were gone a day and a half from Amecameca, but of course two working days were spent and charged in our bill.

Our cavalcade passed through the dusty hot streets of the town, here and there shaded by hedges of cactus or maguey and rows of mesquite trees, the unclouded tropical sun beating upon our heads, though a cool westerly breeze somewhat refreshed us. Leaving the town the road passed through broad wheat and corn fields, and in an hour's ride from the city we left the plain and came to the edge of the foothills of the cordillera of Ahualco, the range from which rises the two volcanoes, of which Popocatepetl is the southernmost.

We were now ascending, and were for several hours to ascend the range, into the pass between the two volcanoes over the trail made by Cortez during his march from Puebla to the City of

Mexico. We met trains of pack mules and donkeys coming from Puebla, and it added no little zest to our ride to recall the memorable march of the Spanish conquistador from the plains of Puebla to the then famous Aztec capital of Tenochtitlan.

In his Essai politique sur le Royaume de la Nouvelle-Espagne, Humboldt refers to this road or trail, which was first opened by the ancient Aztec couriers from Mexico to Puebla by way of Amecameca.[1]

The plains over which we trotted were evidently an old lake bottom. The road now ascended between low rounded hills which had every appearance of moraines; they were composed of loose sand and gravel, with boulders of black basalt like that forming the volcano, and sloped gradually down to the plain. One very regular mound which we passed on our right, which rose abruptly from a corn or wheat field, seemed to have been artificial in its origin. It is Tetepetongo, "the hill of the round stones," and according to tradition, says Ober, was formerly used as a place of sacrifice. But the zone of moraine-like hills we were now passing over contrasted strikingly with the broad flat plains beneath us and with the ragged volcanic foothills of Iztacihuatal far above us on our left. Though this peak was capped with clouds, the larger part of the snowy dome of Popocatepetl was in full view, and from it two glacier-like streaks of snow led down the valleys, losing themselves in the ragged lava streams at the base of the cone. As we pass onward and upward conical tumuli of loose débris from the mountains above confront us, and well-marked lateral moraines extend out upon the plain on each side of the trail. We should judge that the level at which we saw the lowest moraines was about 9000 feet above the sea; from that level they were observed up to or near the snow line, the height of which above the sea, in the latitude of the City of Mexico, Humboldt puts at 4600 meters or 15,333 feet. We were unable to see such good clear natural sections of a

[1] Lorsqu'au mois d'octobre de le l'année 1519, le corps d'armée des Espagnols et des Tlascaltèques marchoit de Cholula à Tenochtitlan, il traversa la Cordillère d'Ahualco, qui réunit la Sierra Nevada ou Iztacihuatl à la cime volcanique du Popocatepetl. Les Espagnols suivirent à peu près le même chemin que prend le courier de Mexico pour aller à la Pueblà par Mecameca, et qui se trouve tracé sur la carte de la vallée de Tenochtitlan. L'armée couffrit à la fois au froid et de l'extreme imptéuosités des vents qui règnent constamment sur ce plateau.—Essai politique, etc., II, 672.

moraine as would have been desirable, but in one instance the moraine was composed of the fine mud scrapings of the lava with rounded boulders of basalt of all sizes up to four or five feet in diameter, the hill being covered with wheat and small corn. Moreover the hills above the moraines on each side of the valley had apparently been molded by ice. I infer from all I saw on the ascent that the ice must have filled the valley or pass between Iztacihuatl and Popocatepetl, spreading out over the plateau like a *mer-de-glace* and sending glaciers down to the lakes then covering the plains of Anahuac. Above the rounded hills were rough volcanic spurs and hills which may once have overlooked the ice streams.

It would appear, then, that the Quaternary lakes of the Mexican plateau (unmistakable evidences of which I saw throughout the country from Laredo to San Luis Potosi, and thence to the City of Mexico, as well as along the Mexican central route to New Mexico) were fed by the melting of glacial ice in the high sierras. At any rate in the valley of Anahuac the volcanoes rising above it must have been covered with glaciers which descended to a point 9000 feet above the sea, and about 1000 feet above the present level of the plains.[1]

The change in vegetation as we left the plains and wound among the moraines was an interesting feature of the ride. The zone of cactus, nopal, mesquite, etc., of the Mexican plateau was replaced by a belt of pines, aromatic firs and cedars; the flowers had changed in character and become more numerous and varied than on the dry and dusty plains; lupines predominated, relieved by a showy red labiate flower and yellow-flowered shrubs. Of

[1] In conversation with Mr. Otto Finck, to whom I described the moraines about Popocatepetl, he told me that what he regarded as true glacial moraines extended down along the route of the Mexican railway as far as Peñuella, which is three miles east of Cordova, and is 2500 feet above the sea, Cordova being 2700 feet elevation. I had seen boulders of porphyry above the city of Orizaba, and Mr. Finck, who is an observer of long experience in the State of Vera Cruz, having explored the country for hundreds of miles on foot, and being a naturalist of experience, kindly took me down to the bed of the river, where were boulders of different kinds of porphyry, evidently derived from the plateau above and westward. On the plains of Jaumatlan and Chocaman, he told me, are boulders of porphyry, weighing 200 tons, and also glacial scratches. Mr. Finck drew for me a section of what he regarded as a moraine observed at the Pass of Metlac, in which were angular blocks of porphyry of ten or twelve kinds, with gneiss, which must have been transported from the plateau above. Below an elevation of 2500 feet Mr. Finck had not in the State of Vera Cruz, or elsewhere in Mexico, observed any glacial marks.

deciduous trees, willows abounded, but few if any oaks. Through these forests, not very dense or continuous, pumas and wolves were said to roam. The insect life of the plains is scanty in the dry season, but in this zone bees and butterflies of different species visited the flowers. The zone of pines and willows was succeeded by a belt of tall coniferous trees like a spruce with a fir-like habit; their slender shafts two to three feet in diameter (in one case of a tree felled with the ax, five feet) pierced the clear sky over perhaps 125 feet. This noble tree had very broad leaves and a deep red bark, like the red woods around the base of Mt. Shasta. This zone of red wood was succeeded by a belt of low short-leaved pines which grew shorter and more stunted until at half-past four we came to banks of snow lying on the summit of the grassy pass, the remnants of larger fields which had but lately disappeared. The air was now cool and even chilly, the ground was damp and often wet; here it was early spring, like our first of April in New England, too early for flowers; scattered plants, perhaps Alpine but quite unlike any we have seen in the Rocky mountains, were not yet in flower, and to add to the resemblance to a northern spring a flock of veritable robins flew among the pines; they were lingering on the flanks of Popocatepetl before taking their final flight northward.

The path to the ranch now left the Puebla trail and led us among the pines to the sheds where we were to spend the night. The rancho was reached at 5.40, and an hour still remaining before dark, I walked to a ravine over piles of volcanic ash and lapilli to entomologize under fallen pine logs and the bark of stumps, finding lizards, beetles, spiders and myriopods quite unlike any forms yet seen in the *tierra templada* below, but with no trace of Alpine characters.

The ranch was a deserted shed and furnace-house for roasting the crude sulphur formerly collected by the *volcaneros* or peons at the bottom of the crater.

Darkness gathered early about the ranch, but in the bright moonlight the massive, marble-like dome of Popocatepetl rose directly above us. Our horses and mules were left to stand in the open air while we bivouacked in the shed, in the center of which was a raised circular fireplace on which our guias made a fire of sticks and logs, the smoke and sparks passing up through a hole left in the middle of the roof. The Indians boiled their coffee in their glazed earthen jars, which in the long run withstand the heat of the fire better than a tin coffee-pot; they made tea for the party in other vessels of domestic manufacture; they refreshed themselves on cold tortillas and chili, the twin components of a Mexican meal, and then cut out their sandals for the morning's climb, while we dismembered a cold broiled fowl of pronounced toughness and ate it with excellent native bread and tea. To the tourists and head-guides was assigned a sort of low raised divan or floor covered with hay, over which we spread the straw *petates* or pallets, and finally a blanket, with a second blanket and a coat over us. The *guias* and muleteer lay on the mud floor, their feet to the fire; their swarthy faces and limbs not visible in the gloom, their white cotton garments concealed by their high-colored serapes or blankets. They slept soundly through the night, but not the tourists; the beds were uneven, an occasional flea danced a jig on our hands and faces, a rain and hail storm with a strong gale of wind rattled about the ranch; towards morning it grew very cold and chilly; added to this two of our number, owing probably to the altitude, were unfortunately seized with vomiting and diarrhœa, so that there was little or no sleep for the Americanos that night.

At 3.40 A. M. of the 20th I awoke the party, the *guias* replenished the fire, prepared the coffee and tea, saddled the uneasy horses now shivering in the cold frosty morning air, and at 5.30 we had mounted our steeds and were under way for the peak. It was a bright, crisp, clear, cold morning, the stars still shining brightly, while a piercing cold wind swept down the valley over the pass. Our guides had wrapped their legs in thick layers of cotton rags, wound their *serapes* tightly about them, and we found that our overcoats and gloves were but a slight protection against the intense cold. For two hours we slowly crept up by a zigzag trail, urging on our unwilling nags over the slope of the mountain; first passing through the pine woods, then descending a barranca or ravine, through which ran a stream fed by the snows of the peak. The trail then wound along the base of the cone over fields of loose, deep, coarse, black, volcanic sand, through which rose scattered jagged masses of black lava. Our faltering horses and not over enthusiastic guides toiled upward and onward, until at 7.30 we reached La Cruz, a rock on which was a wooden cross, where we were to leave our horses and begin the ascent on foot. Here, owing to sickness induced by the altitude, my companions were obliged to return to the ranch. Taking Rafael and two *guias* I went on.

The ascent of Popocatepetl is prosaic in the extreme. Much to my surprise there were no rocks to clamber over, no difficult climbing, but an interminable steeply inclined desert of deep, coarse, yielding, volcanic sand, covered with a thin sheet of snow —névé—making it exceedingly hard walking, to say nothing of the effect of the great altitude upon the heart. The height of the lower level of the snow-line Humboldt estimated at 15,300 feet.

The cone of Popocatepetl is like that of Vesuvius—only more so. We roughly estimated the angle of the slope at 30°, but judging by our feelings after two or three hours' climb, it seemed like 75°.

There is no definite trail up the mountain, and at no point on the route can the summit or mouth of the crater be seen, so that there is no goal in sight to draw one's attention away from the labor and fatigue of the ascent. Looking up hopelessly from time to time as we stop to get breath, anxiously trusting to obtain a glimpse of a rocky peak breaking through the crust, nothing meets the eye but a vast snowy slope melting away far aloft in the sky, the unsullied surface like polished marble of more than parian purity, fading gradually away to be replaced by the deep, fathomless azure of a Mexican sky.

By eight o'clock the sun had gained more power, the exercise warmed us, so that we no longer suffered with the cold, but the effect of the intense sunlight upon the eyes was blinding and painful; it would have been well-nigh impossible to have made the ascent without blue goggles.

Our small procession moved in the following order: my own particular *guia*, a young, stout, willing Indian picked out a way over the rough snow or sand, as the case might be, the writer followed, planting his feet in the prints made by the Indian, and supporting himself with a rude, improvised alpenstock, usually held in both hands; behind followed the supernumerary *guia*, carrying the lunch basket on his back, while Rafael brought up the rear, with the air of one fulfilling a contract rather than enjoying the ascent. And it was hard work. I have ascended Pike's peak three times, walked up Gray's peak twice, have climbed the crater of Mt. Shasta, which is over 12,000 feet high, ascended

Vesuvius and Snowdon, and not a few peaks in the White mountains, the Adirondacks and Northern Maine, but the labor of the ascent of Popocatepetl, owing to the far greater altitude and the consequent rarity of the atmosphere, as well as the yielding sand and the nature of the snow is peculiarly difficult.

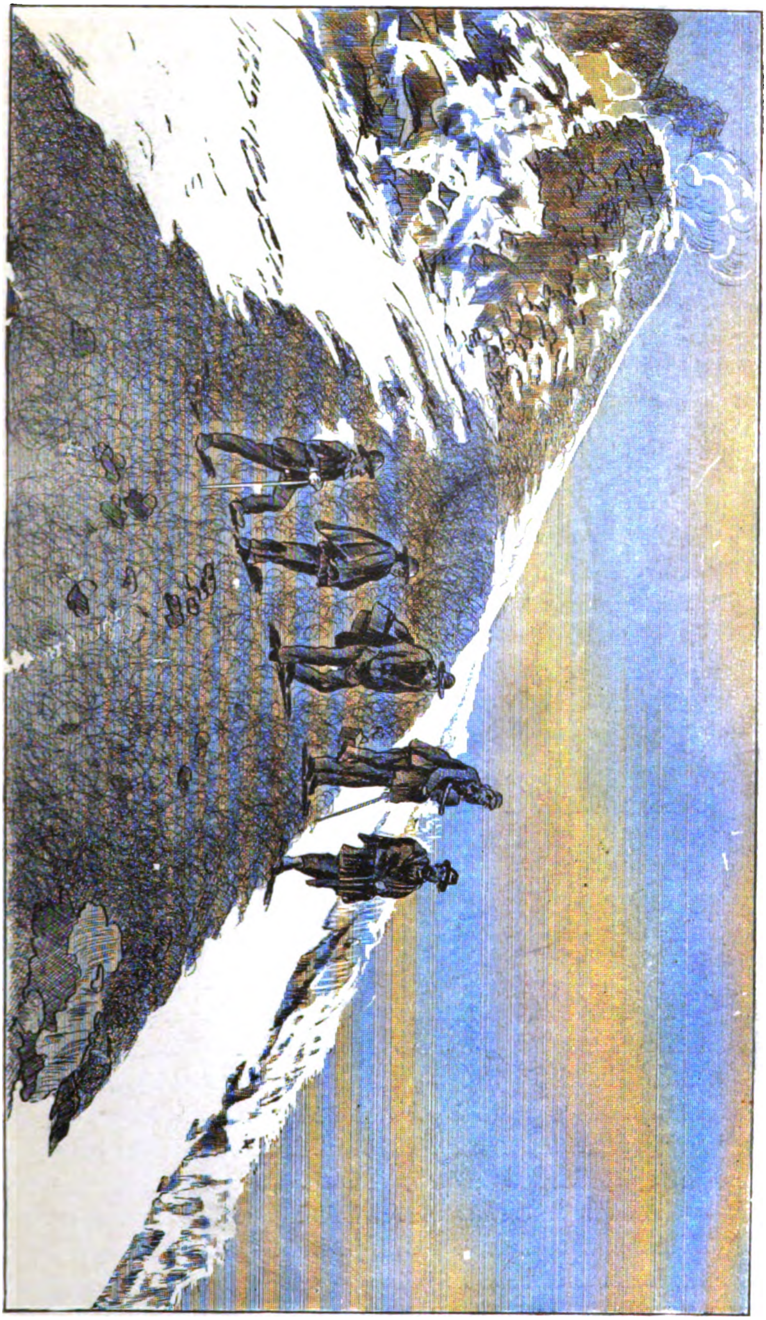
To my surprise the snow lay on Popocatepetl as a thin sheet of from a foot or two to six or eight feet thick—deeper of course in the ravines, but the ravines were of a mild type. The ascent is made from the northerly and westerly side; the deepest ravine was filled with snow passing beneath into ice, thus forming an incipient glacier perhaps nearly a mile in length. Looking at it the day previous, from the road below, I supposed it to be a true glacier filling the ravine, but it can scarcely be regarded as such, whatever may have been its dimensions in early times.

The surface of the snow fields over which we walked was exceeding rough. The snow was, on the average, about three feet deep, cut up by deep narrow fissures lying at various angles to our line of march; the footing was thus very rough and uncertain; the snow grew softer as the sun rose higher, and it was impossible at times to prevent slipping and falling down. Four hours of such work to one not hardened to mountain climbing at such an altitude, reaching nearly or quite 18,000 feet, are no child's play. One advances three or four steps, and thoroughly exhausted sinks down upon his staff to rest and recover his breath; his heart beats in a wild extravagant fashion, and his breathing is short, quick and labored. No one should attempt the ascent who has not a healthy heart and sound lungs, and is not under fifty. There is danger of over-fatigue.

At about half-past ten the summit seeming no nearer than at the start from La Cruz, I asked Rafael how long it would take to reach the top. He, thinking I might give it up, craftily replied, "*dos horas;*" not satisfied with this I privately asked my trusty guide in front, and he said, "*una hora.*"

Just then a whiff of sulphur vapor passed by, the draught though nauseous was inspiring, and gave new strength to my tired limbs, and at eleven o'clock I suddenly walked over the edge of the crater and could look part way down into the bowels of Popocatepetl. We were on the summit, could walk on level ground along the narrow sandy edge of the crater, without fatigue, the heart at once resumed its normal beat and the respiration became again natural.

PLATE VI.



Summit of Popocatepetl, just within the north-west edge of the crater.

The transition was thrilling. Here we were on the summit of the highest mountain between Mt. St. Elias in Alaska, and Chimborazo in Peru! The sky was well-nigh cloudless, a few cottony masses hung over Iztacihuatl to the north of us, partly obscuring its peaks; the plains of Anahuac and the Puebla valley bathed in the sunlight, and wrapped in a warm, soft haze, stretched for hundreds of miles away west and east; the volcano of Malinche to the north-east seemed like a pigmy cone; the city of Puebla could be distinguished, but Cholula and its pyramid, which lay nearer, were lost in the haze; we could not detect the city of Mexico and its adjoining lakes, nor could I make out the volcano of Orizaba, which lay to the eastward 150 miles.

But our interest centered in the crater. In comparison with that of Vesuvius or Mt. Shasta it was, it must be confessed, tame. Many have looked down into the crater of Vesuvius; that of Mt. Shasta is a funnel-shaped chasm over a thousand feet in depth, the snow fields extending from the rim to the bottom, in which lies a frozen lake. The view into it was memorable.

Descending a few feet to a rock overhanging the chasm now before us, we could take in the entire basin. It seemed to us to be about 500 feet deep and from 1000 to 1500 feet across at the mouth, but according to Gen. Ochoa's measurements it is a thousand feet deep, and the floor is 200 meters in circumference. It is not an irregular chasm like that of Vesuvius, but like a vast cauldron in shape, the steep sides visible all around, and the bottom broad and somewhat flat, with no large, deep fissures visible. Gen. Ochoa told Mr. Ober that there are more than sixty solfataras or smoking vents in the crater, one of them over fifty feet in circumference; he called the vents *respiradores*.

The northerly rim is of loose volcanic sand which has been blown up out of the crater. Perhaps two-thirds of the rim was of solid lava more or less jagged and irregular, the highest portion on the south-east side. Looking across from the northerly side one is confronted by three well-marked layers of vertically columnar basalt marking three successive overflows, while a less regular fourth layer indicated an additional eruption. The rock composing the sides of the crater, the mountain itself and the sand lying on its flanks is a tough, black basalt, slightly porphyritic.

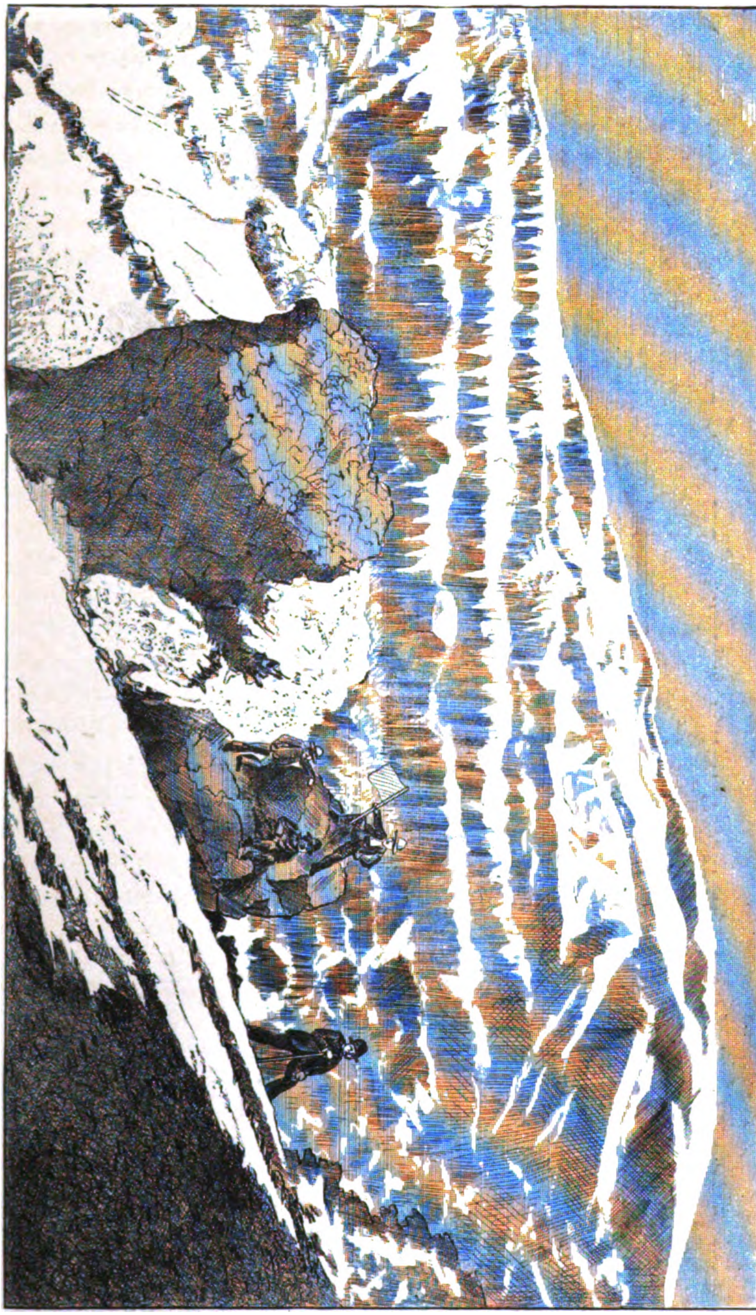
Near the rim of the crater on the west side is a sulphur fumarole or *respirador*, a fissure from which issued clouds of sulphur fumes. At the bottom of the crater were plainly seen two large sulphur vents or solfataras, with smaller ones from which clouds of vapor rose perhaps to a height of over a hundred feet, but certainly not half way up to the edge or top of the peak. Whether these fumes can be seen from below, at the base of the mountain, is a question. Some still claim that the mountain smokes, and that the smoke can be seen from below, but this is doubted. The assertion was made in the time of Cortez. Humboldt says: "Ce volcan, que j'ai mesuré le premier, est constamment enflammé; mais depuis plusiers siècles ou ne voit sortir de son cratère que de la fumée et des cendres."[1] It is not impossible that the slight amount of sulphurous vapor which is emitted from the crater may at times increase and be visible at night by moonlight from the plains below, or even in the daytime during certain states of the atmosphere; I well remember that in May, 1872, a month after the great eruption of Vesuvius, no smoke was seen to rise from the crater by day, but by moonlight, at Naples, I could detect a slight column of vapor hanging over the summit of the cone.

The sulphur vents were surrounded with masses of bright yellow sulphur. Near where we stood were two or three stumps of posts which had been driven into the volcanic sand and gravel to support a windlass or winch, by which the *volcaneros* were let down into the bottom of the crater to gather the sulphur there. It was borne in sacks on the backs of Indians down to the ranch or sheds where we spent the night, and there sublimed in earthen pots. The crater was not measured until 1856, when General Ochoa estimated its depth and circumference. We roughly guessed that its depth was about 500 feet, but distances, looking down into a mountain, are very deceptive. It appears that in the time of Cortez a Spaniard descended the crater, tied to a rope, to the depth of from seventy to eighty fathoms or 420 to 480 feet.[2]

[1] Essai politique sur le Royaume de la Nouvelle-Espagne, Tom. II, p. 238.

[2] "Ou voit, par la troisième et la quatrième lettres de Cortez à l'empereur, que ce général après la prise de Mexico, fit faire d'autres tentatives pour reconnoitre la cime du volcan, qui paroissoit fixer d'autant plus son attention, que les indigènes lui assuroient qu'il *n'étoit permis aucune mortel de s'approcher de ce site des mauvais esprits*. Après deux essais infructeux, les Espagnols réussirent enfin, l'année 1522, à voir le cratère du Popocatepetl; il leur parut avoir trois quarts de lieue de circonférence, et ils trouvèrent sur les bords du précipice un peu de soufre qui avoit été

PLATE VII.



Within the edge of the crater, looking across to the lava beds on S. E. side, forming the highest point of the summit.

An hour was spent on the inside of the edge of the crater, where we ate our lunch. The air was delightfully clear and cool. We were wonderfully fortunate in having so clear and bright a day, as the peak is usually covered with clouds by ten o'clock, and for this reason we were advised to start from the ranch by daybreak. The summit is of small extent, the edge of the crater is quite free from snow, but a few feet down on the outside from the edge on the north side, the snow begins as a perpendicular wall, three or four feet deep, like a petrified crest of a wave, as if the snow had been melted by the breath of the crater. The following week on visiting Puebla, which lies due east of the mountain, we observed that there was no snow on the eastern and southern sides of the volcano, the snow fields on the northern side being preserved from melting by their more shaded situation. Without doubt the snow fields of Iztacihuatl, which extend along the western side of the range, are also thin, and give rise to no extensive glaciers.

Whether there has been an eruption of Popocatepetl in historic times is a matter of doubt. It is possible that showers of ashes may have been blown out of the crater, but certainly there is no recent stream of lava or obsidian on the mountain slopes. Humboldt, however, quotes from a letter of Cortez stating that much smoke rose from the crater, and that clouds of ashes enveloped two men who ascended part way up the mountain.[1] From this it would seem that the volcano was rather more active three and a half centuries ago than at present, but it is to be doubted whether there has been an actual eruption of lava within a thousand years. According to various authors there were eruptions in 1519, 1539 and 1540.

déposé par les vapeurs. En parlant de l'étain de Tasco dont ou se servit pour fondre les premiers canons, Cortez rapporte, 'qu'il ne manque point de soufre pour fabriquer de la poudre, parce qu'un Espagnol en a tiré d'une montagne, de laquelle sort perpétuellement de la fumée, en descendant, lié à une corde, à la profondeur de 70 à 80 brasses.' Il ajoute que cette manière de se procurer du soufre est tres dangereuse, et que par cette raison il sera plus prudent de la faire venir de Serville" (Essai politique, etc., II, 673). The depth of eighty brasses or fathoms would be 480 feet.

[1] However Cortez expressly says, "That their men ascended very high, that they saw much smoke go out, but that none of them could reach the summit of the volcano, because of the enormous quantity of snow which covered it, the intensity of the cold and the clouds of cinders which enveloped the travelers" (Essai politique, etc., II, 672).

Here in passing I may remark that Orizaba is now said to be slightly higher than Popocatepetl, though Humboldt claimed that the latter was 600 meters higher than any other mountain from Mt. St. Elias to the Isthmus of Panama. Mr. A. H. Keene, in the Encyclopedia Britannica, gives the height as 17,176 feet. I obtained excellent views of this noble volcano at different points along the Mexican railway to Cordova. Seen from the west the snow fields stretched in glacier-like streaks down its slopes; at the station of Esperanza, however, the clouds parted so that the summit could be seen from the south, and it was observed that the dark streaks of sand or rock extended in broken patches to the very summit. Orizaba rather disappointed me from this point; it is far less imposing and majestic a peak than Popocatepetl; it is not so isolated, its great height being apparently lessened by the high mountains of the Sierra Nigra extending from it towards the railroad. Moreover its summit is broken up into subordinate peaks. Farther on near where the railroad descends into the great *barranca* or ravine west of the town of Orizaba, the volcano of that name is seen to be of solid lava, furrowed by deep ravines; while Popocatepetl is more like a vast conical heap of ashes. Never, however, shall I forget the magnificent view of Orizaba which I had from under the coffee trees and bananas of Cordova. It was eleven o'clock in the morning, the clouds had lifted and rolled away from the mountain, which rose in a magnificent conical mass far above its humbler fellows of the Sierra Nigra. From the illustrations given by Humboldt I imagine that the finest view of this imposing peak is from the forest of Xalapa, to the north-east. This volcano is said to have been quiet since 1566.[1]

[1] Mr. Hugo Finck of Cordova, who has explored the base of Orizaba, told me that the crater is one and a-half miles long and a half mile wide, but that it cannot be entered. He saw Orizaba smoking, probably the gases from the solfataras, and stated that the mountain had erupted near the base, where there are small craters. He has seen a glacier near the summit, and thinks there are others; they slide down and melt away, the summit above being bare, with no *mer-de-glace.*

It seems probable that there are at the base of Orizaba Archæan rocks, as Mr. Finck told me that gneiss occurs as far up the sides of the mountain as 13,000–14,000 feet, while higher up the mountain is composed of a grayish porphyry. In the center of the Sierra Nigra and the mountains southward between Esperanza and Orizaba, are Silurian, Devonian, and Carboniferous strata with a fœtid black limestone, succeeded by bluish Jurassic limestones containing fossil fishes, oysters, belemnites and ferns. In the Cretaceous hills three miles east of Cordova fine ammonites occur. It seems probable from what Mr. Finck told me, and my own hasty observations from Mexico to Cordova, that all these principal formations occur from the center of the Mexican plateau to the seacoast at Vera Cruz, the plains of the latter State being of Tertiary and Quaternary age.

But we must reach Amecameca by dark, as in traveling through the woods after twilight we might fall in with objectionable company.

At twelve o'clock we began the descent, and it reminded me strongly of the twenty minutes' descent or run down Vesuvius. After zigzagging down over the snow and ice, now quite yielding, stopping frequently to rest one's tired knee-joints, on reaching the sand below the snow fields, my two guias each took one of my arms and we ran down the long sandy slope arm-in-arm. We reached La Cruz by about two o'clock, and walking on a mile or so more down the slope, I found a horse which Mr. Ober had sent me, in waiting. Reaching the ranch at about three, after half an hour's rest and refreshment, Mr. Ober and myself rode with our guide Rafael fifteen miles to Amecameca, while our *guias* trotted the whole distance on foot behind their pack mules.

Nothing is more monotonous in its flatness than a Mexican bedstead, while the mattress is only thicker than a Mexican blanket, the bed being but a little more yielding than the soft side of a pine board, but that night—spent in a second-class Mexican hostelry, after such a long day's work with the alpenstock and in the saddle, half frozen in the morning on the mountain side and half roasted in the hot mountain gorges and on the dusty plains in the afternoon,—that night was given without reservation to the worship of Morpheus. The next day at ten we reached the site of ancient Tenochtitlan, rested in the grand plaza under the shade of the orange and banana, by the plashing fountain, our eyes feasting on the varied, ever-changing pictures of Indian, Mestijo and Spanish types of Mexican life passing before us in that famous square.

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NOTES ON THE ŒCODOMAS, OR LEAF-CUTTING ANTS, OF TRINIDAD.

BY C. BRENT.

AN opportunity was afforded me during the winter of 1884–5 for studying the life and habits of this most interesting species on the Island of Trinidad, West Indies. Several species are here distinguished; all, however, are alike in form and habit, the variety being produced by variation in size and color. These insects are extremely numerous, indeed one cannot take a walk anywhere in the country without observing broad columns of seemingly animated leaves marching across the roads. Complaints are heard on every hand of their ravages among the gardens and plantations. Agriculture is all but hopeless in sections infested by these pests, since although they occasionally attack one of the forest trees, they show a decided preference for the leaves of cultivated trees and garden plants, the cocoa, coffee and orange being particularly subject to their destructive visits. They seem also to develop a "penchant" for particular trees. One orange tree in a grove of the same species is stripped again and again, while the neighboring trees are left untouched. The curious habit these ants possess of cutting and carrying off immense quantities of leaves, has often been noted in books on natural history, although the question is still an open one as to the object of the custom and the disposal of the cut leaves. My own observations on these points I shall give farther on.

The speed with which these little workers operate is indeed marvelous. A good sized mango tree, at least as large as an average apple tree, I saw stripped of every leaf in one night, and greater feats than this are recorded of these "Tourmi Ciseaux," as they are called by the Creoles. In the morning the naked boughs bore only the bare midrib of the leaves with here and there jagged portions of the parenchyma left by the circular pieces snipped off. The ground was littered with circular pieces of leaves about the size of a ten-cent piece, which the ants had neglected to carry off. Old leaves and young had alike been snipped off, but most of the pieces left were cut from the older leaves.

During the day I discovered the formicarium to which these ants belonged, some three or four hundred yards up the mountain side. It was situated on a gently sloping incline covered by a dense "vastrajo," or second-growth wood. The site of the hill had been well chosen in a spot free from large trees, and the smaller bushes had been removed, leaving the soil as bare as if the vegetation had been destroyed by a fire. The mound was of immense size, being about forty-five feet across and about two feet high. The soil was of a different color from that of the surrounding hillside, and consisted, I found, of clayey granules brought up by the ants from the subsoil below. No signs of ants were visible, nor were any recently used entrances to be seen. Several tunnels extended a short distance into the mound, but they were all *stopped* up by soil washed into them by the deluging rains that had been falling for several previous days. Cutting my way through the bushes by means of that useful and indispensable part of a forester's outfit for tropical woods, the "machete" or cutlass, I found, some twenty yards up the hillside, an entrance from which led, as far as the eye could see, a wide smooth path, worn by repeated travel some five inches deep, and carefully cleaned of all vegetation, dead leaves and rubbish. A few yards from the entrance a huge tree had fallen but recently across the pathway, but the industrious insects had dug a tunnel six inches in diameter under it in preference to climbing over it or making a new path around it. A little farther on I met another instance of formic ingenuity. The path led to the edge

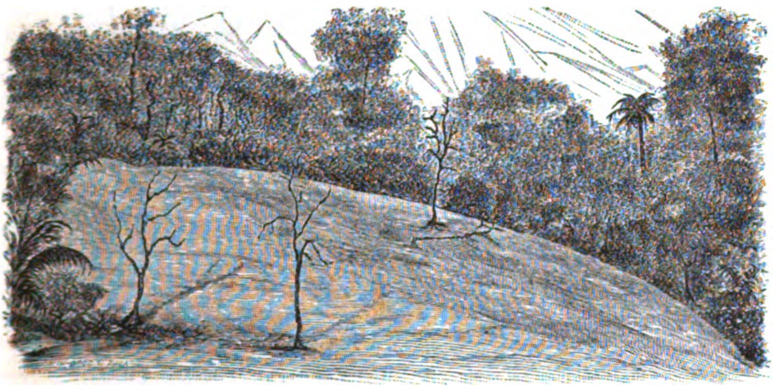

FIG. 1.—An Œcodoma formicarium. The cleared space is forty-five feet in diameter.

of a ravine where it branched; one branch led directly across the ravine, down the precipitous sides of which an oblique path had been excavated at an angle of about 45°; the other branch led up the edge of the ravine some twenty yards to a fallen tree which spanned it. Over this the pathway led to the opposite bank, down which it ran to join the direct path below. I subsequently noted that during the rainy season when the ravine held a stream of water, the ants toiled up the hillside to their bridge, but as soon as the water dried up they used the nearer path directly across the ravine. On looking around the mound I found five other entrances to the formicarium, all at some distance from it, and from each of these diverged a pathway through the woods. Along one of these traveled a dense column of ants, those outward bound keeping the right hand side, while those returning home traveled along the left. The incoming ants were nearly all laden with their leafy burdens which they carried tightly gripped between their mandibles, sometimes nearly upright, or thrown back so as to completely hide the insect below. This curious fashion of carrying the leaves has earned for them the common English name of "parasol" or "umbrella ants."

Along the path were several heaps of leaves, which were probably carried away by a fresh relay of workers; often these heaps may be noticed lying deserted along the pathways, but they are invariably removed, sooner or later, to the nest. The leaves

FIG. 2.—Ants at work leaf-cutting.

were those of the cocoa, so I traced the column down the hillside some four hundred yards to the edge of a cocoa plantation, where I found them actively engaged in leaf-cutting. The smaller trees were swarming with the little depredators, leaves were falling plentifully as the little sawyers snipped them out. Numbers of ants marched up the tree and numbers marched down, very deftly managing their awkward-looking burdens. Sometimes they progressed sidelong down the tree, sometimes backwards, according to the condition of the surface over which they walked.

In operating on a leaf the ant places herself upon the upper surface near the edge, and saws a circular cut nearly all the way round with a saw-like motion of her finely serrate mandibles. To prevent the section falling she does not saw it all round, but when nearly severed seizes it by the edge and by a sharp upward jerk detaches it. Now she either marches directly off to the nest or lets the fragment drop to the ground and begins sawing another. Often quite a heap of pieces accumulates beneath the busy little sawyer.

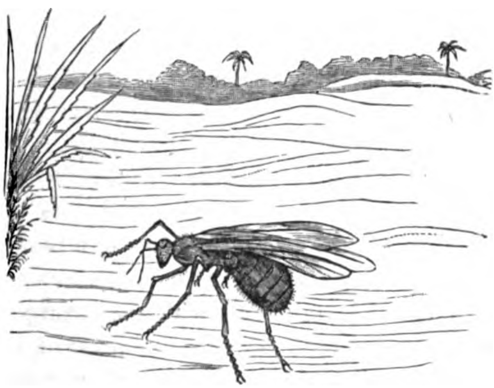

FIG. 3.—Œcodoma of Trinidad, male.

The Œcodomas are differentiated, as in other species, into males, females and workers, the latter being of course undeveloped females. Four classes may be distinguished among the workers, only two of which take part in the foraging expeditions. The majority of these workers are of a pale reddish color with a

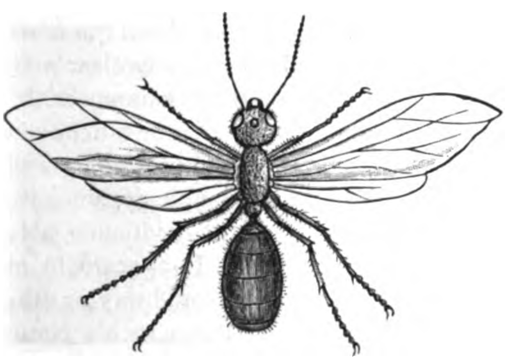

Fig. 4.

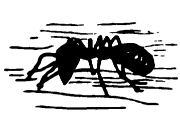

Fig. 5.

Fig. 6.

FIG. 4.—Female. FIG. 5.—Worker major, or so-called soldier. FIG. 6.—Worker minor. All natural size.

stout body, short round unpolished head, which carries behind a pair of spines. The thorax is very sharply constricted in the middle, the fore part, or prothorax, carrying the first pair of legs and a pair of spines upon the dorsal surface. The hinder part, or meso-metathorax, carries the other pairs of legs and two pairs of spines. The cutting instruments are a pair of long extremely sharp-pointed mandibles finely serrated upon their inner surface, which may be used as saws or nippers. The workers vary extremely in size; individuals are met with only three-sixteenths of an inch in length, while others attain a length of nine-sixteenths. These smaller (younger) ants accompany their older sisters in their expeditions but rarely carry leaves. They may often be seen riding upon the burdens of their older and larger sisters as if tired. I have observed as many as three clinging to a leaf which was carried with apparent ease by one of the larger ants. A number of these little ants may be observed to issue from the mines with the old ones and loiter around the entrances as if as yet unable to take part with the stronger ants.

Here and there among the mass of workers, perhaps forming about one per cent of the total number, may be seen a much larger, formidable-looking ant with enormously swollen triangular head, which takes no part in the work, but always accompanies the "worker minors," as they are called, on their expeditions. I spent much time trying to find out the functions of these large-headed ants, but failed to get any clear notions as to the part they play in the politics of the commonwealth. They may nearly always be seen on a bit of stick or other eminence, caressing now and then the antennæ of the passing ants with their own. Talking, we may suppose, in ant language, since it is well established that ants are, by means of their antennæ, able to communicate their ideas one to another. It appears to me that these apparently useless ants directed in some way or other the movements of their working sisters. Bates in his Naturalist on the Amazons, came at first to the same conclusion, but afterwards abandoned this idea for one I think not more tenable, namely, that these ants by their superior size draw upon themselves the attacks of ant-eating birds, &c., being thus, as he terms it, merely "pieces de resistance," thus only serving to preserve the main body of workers by a self-sacrifice of mere "passive" resistance.

I went to the trouble to shoot several ant thrushes and Dendrocolaptes which feed almost entirely upon ants, to see if there was any foundation for this theory, but found very few indeed of the so-called "worker majors," although the crops were distended with "worker minors." In other works on natural history they are termed "warriors," but they by no means correspond to the warrior or soldier class in the Termites, for instance. They have no special offensive or defensive weapons, their movements are more sluggish even than those of the smaller ants, and when the nest is disturbed by poking it with a stick, the smaller ants only prove pugnacious. In the battles which so often occur between the mail-clad bandits of Trinidad forests, the savage "Ecitons," or "hunting ants" and the "parasol ants," the brunt of the fight is borne by the "worker minors" who always drive off the marauding Ecitons.

In some Œcodomas there is a series of intermediate forms between the working minors and the working majors, and in some species all take part in leaf-cutting. Besides these workers there are two other classes, which never leave the mines, the worker nurses, to be distinguished from the working minors chiefly by their hairy heads, and another class of very large ants, individuals of which are found nearly an inch in length. This class is represented in each formicarium by only a few individuals, which are distinguished by their large hairy heads and the possession of a twin ocellus placed in the middle of the forehead. These never leave the mines, and are seen only when the formicarium is opened.

The ant hill referred to above being a pest to the neighboring plantations, it was determined to destroy it. Poisons were found useless. Corrosive sublimate and potassium cyanide were mixed with farina and deposited near the nest. These were simply ignored; the ants would not touch them after a few had fallen victims. A solution of arseniate of soda was next sprinkled upon orange leaves, which were strewed upon the mound. These were eventually cleared away, although at an immense sacrifice of life. This points, I think, to the true ant food, since unless the juices of the leaves as they were sawed up were swallowed, the poison would have had no effect. This idea is strengthened by the fact that fiery and strongly aromatic plants as well as those with poisonous, milky juices are carefully avoided. No solid food is found in the crops of the insect at any time, but if these are examined after the insects have been engaged in leaf-cutting, they are found full of green leaf juice. Finally we destroyed the nest by drowning, the common method during the wet season. A number of channels were dug in the hillside, all constructed to collect the rainwater as it streamed down the hill, and to pour it into the nest by one of the entrances. I visited the nest during the next rain to see how the plan was working, and was surprised to find the water pouring out of an orifice twenty yards below the nest. After the rain I examined this tunnel and found that it entered the nest at the lowest point, some eight feet below the surface. I examined many formicaria subsequently, and invariably found this lower tunnel wherever the inclination permitted its construction. I have no doubt that it is constructed as a drain, and that the ants know as much about the advantage of thorough drainage as they have been proved to know, by many eminent observers, of those of other sanitary matters. On opening the mound, some three feet below the sur-

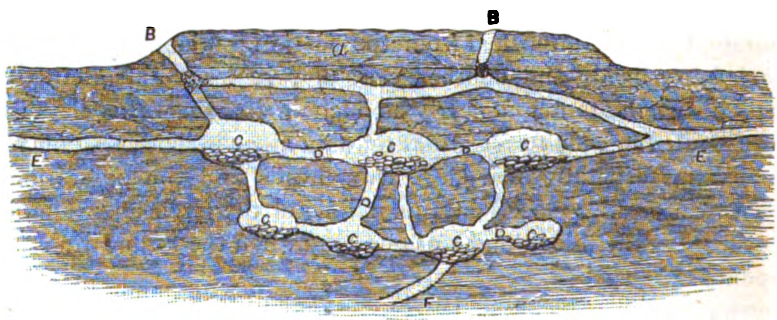

FIG. 7.—Diagrammatic v. section of an Œcodoma formicarium, depth about eight feet. *a*, mound of clayey granules; *B*, unused entrance; *C*, chambers containing leaves; *D*, connecting corridors; *E*, tunnels to distant entrances; *F*, drain from lower level of mines.

face was found a series of hall-like cells, some three feet in their larger diameter, connected with each other by short smooth corridors. From the outermost of these proceeded the tunnels communicating with the surface by the orifices mentioned above. Below there was a second series of somewhat smaller cells, the lowest of which was entered by the drain just referred to. The central chambers were all washed out, but several of the lateral chambers had escaped damage. In these were found bushels of leaves, several of the large cyclopean ants, many nurses, larvæ, and an Amphisbæna. This lizard is generally a guest of the parasol ants, and repays their hospitality by feeding upon them. The natives firmly believe that the "serpent a deux tetes," as they call it, is the mother of the ants, and that they procure the leaves for the purpose of feeding it.

The larvæ were imbedded in a soft woolly matter which proved to be the finely masticated parenchyma of the leaves. Thus a use was found for the leaves, although it reflects seriously upon the supposed sagacity of the ants that they should procure so many more than are required for the purpose. Bates states that the leaves are also used for thatching the domes over the entrances to the mines, but I have not observed this practice in connection with the Trinidad species. The larvæ are fed by juices secreted by the nurses. A part of the larvæ emerge from the eggs winged and ready for their nuptial flight. These are the males and females, and the swarming occurs during the wet season. The female measures an inch in length and two inches in expanse of wing. The wings are clear, transparent and coarsely veined. The winged males and females emerge from the woods in clouds during the rains of April and May. These are almost all destroyed by the flycatchers, jackamars, ant-thrushes, &c., which greedily devour them; only a few impregnated females survive the slaughter to found new colonies and propagate their race. The colony is sustained, I suppose, as in other species, by the seizure and detention of impregnated females by their own subjects. After impregnation the female loses her wings, these being broken off by the insect itself. There may be noticed a natural suture at the base of the wing, doubtless that this may be easily broken off when no longer required.

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THE TEREDO, OR SHIPWORM.

BY R. E. C. STEARNS.

THERE are several species of what are popularly called "shipworms" which are ordinarily included under the name Teredo. Although to the common observer they have a worm-like appearance, they are not worms, but true shell-bearing mollusks, as much so as the common "long clam," "long-necked clam" or "mananose" (*Mya arenaria*) of the Atlantic coast of the United States.

So much has been written in relation to the shipworms that it would be nearly impossible to write anything that would not be a repetition or quotation. The shipworms (Teredo) were known to the ancients, and Theophrastus, the friend and successor of Aristotle in the lyceum at Athens, observed their operations 350 B. C.

The late Dr. J. Gwyn Jeffreys,[1] in his excellent volumes on the mollusks of Great Britain, presents in a very concise and interesting way what is in fact a most valuable memoir on the shipworm, Teredinidæ.

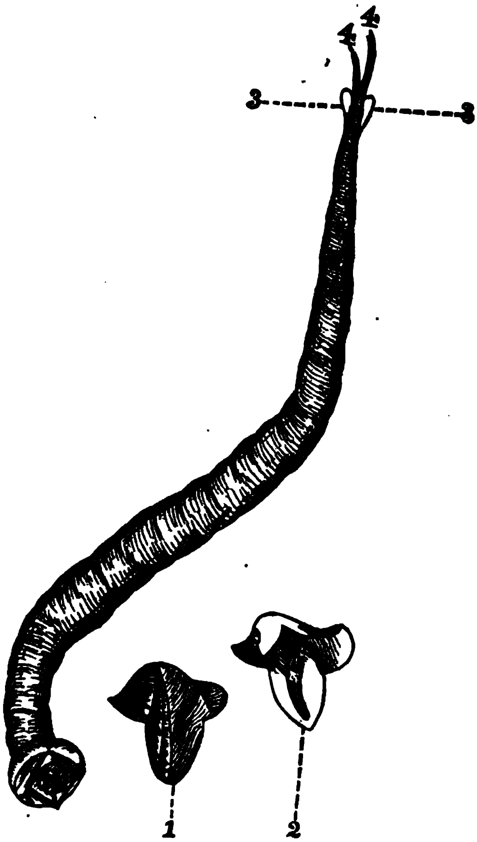
The shipworms are *bivalves*, that is to say, the complete shell is in two pieces, although one can form no idea of the Teredo from them, as the shelly part is but an insignificant portion of the entire animal, as you will learn from the following:

"The Teredo * * * consists of a long and nearly gelatinous, worm-like body, without rings or segments, terminating at one end in a pair of * * * valves that somewhat resemble the two halves of a split nutshell which has had a large slice cut off at each side, and at the other in a pair of symmetrical shelly paddles with handles of different lengths, which close this extremity at the will of the animal. The open part of the bivalve shell is placed at the further end, and receives a circular disk of a fleshy or rather muscular nature, which may be termed the foot; this is the broadest and widest part. Inside each valve is seen a curved process, like a bill-hook, that projects from the hinge at a right angle. The shell covers and protects the mouth, palps, liver and other delicate organs. The body tapers gradually to the outer or nearer end, where it becomes quite small and attenuated; it contains the gullet, intestine and gills, which form at the outward point two cylindrical tubes, mostly of unequal length. The larger tube takes in infusoria or similar animalcules, which constitute the food of the Teredo, as well as imbibes water charged with air for the purpose of respiration and keeping the whole fabric moist, while the smaller tube is employed in the ejection of the water which has been exhausted or deprived of aeriferous qualities, and also serves to get rid of the woody pulp that is excavated by the Teredo. Both tubes form a kind of hydraulic machine. At the base of each lies one of the paddles often termed 'pallets.' * * *

"When the Teredo is alarmed, or not feeding, it withdraws its tubes into the neck of its sheath or shelly cylinder; and the pallets which had been previously kept pressed against the sides, then spring forward and close the opening so as to form an efficacious barrier against all foes," etc.

[1] British Conchology, Vol. III, pp. 122–184. See also the Dictionaire Universal d'Histoire, Vol. XII, p. 358, under the title "Taret," and the Encyclopedia Britannica, Vol. XV, p. 353, under "Mollusca."

"The whole of what I have endeavored to describe is found only within some hard vegetable substance, either the hull of a vessel or boat, a harbor pile, a shipping stage, a floating tree * * * a beacon or buoy," raft timbers, old spars and masts, the planking or bracing of wharves, bridges, &c., &c., and old hulks or wrecks. The Teredo bores into these the same as a



1, outside of one of the shells; 2, inside ditto; 3–3, pallets; 4–4, siphons.

rabbit or mole in the earth, making a continuous gallery or hole quite smooth inside and cased or lined with shelly matter forming the sheath or cylinder above described. This shelly wall or lining or cylinder is so fragile that it is quite impossible to split the wood containing one and get it out or even a portion of any considerable size; the blow necessary to cleave the wood shatters the shelly lining of the Teredo's gallery or burrow into countless pieces.

These burrows vary from one quarter of an inch or less to half an inch or more in diameter.

It is only in its very earliest stages that the Teredo is a free moving animal. At this time no one other than a practiced naturalist would be likely to recognize it. "It is very minute, nearly spherical, and covered with cilia or hair-like projections, by means of which it swims rapidly through the water. In thirty-six hours it assumes a new form, and speedily changes it for another, after which it returns again to its original form, so that in a very few hours the little creature is first spherical, then oval, then triangular, and then spherical again. In this stage of existence it possesses a foot which enables it to crawl after the manner of snails, and also has organs of hearing and sight."

It does not enjoy its locomotive powers for any long time but fixes itself to some suitable object, passes through its last change, becomes a veritable shipworm and begins its lifelong task of boring.

The Teredo is not very particular as to the kind of timber into which it bores, but always goes with the grain, unless it meets with some obstacle, such as a nail or a very hard knot; and in such a case it turns out of its track for a short distance and then resumes its former course. As it bores its way along, it lines the tunnel (as before stated) with a coating of shelly matter, but this is not attached or in any way connected with the body or substance of the shipworm.

It is not believed that the wood it perforates furnishes any nutriment to the animal, but that its sustenance is derived entirely from the water which is constantly passing through its body.

The holes made in the wood at the time or just after the young Teredos commence burrowing are quite small, the appearance of the surface of a pile or other infested timber is usually deceptive, affording but little evidence of the size or number of the burrows or the extent of the ravages within. After awhile the interior is so completely "honeycombed" that a slight blow or bump by a vessel upon the outside shatters the pile, &c., and their damaging work can be seen.

Upon the water front of San Francisco I have known piles, of Oregon pine and fir over a foot in diameter, rendered worthless in eighteen months, and have heard of even a more rapid destruction of wharf piles in the harbor of that city. In one instance reported to me the destruction was accomplished in about six months. In the case which came under my notice, as above, the wood of the pile had not lost its original fresh or bright appearance when it had to be removed from the wharf and a new one put in its place. My friend, Mr. Dall, informs me of a case of the destruction of the supports of a small pier made of piles (probably pine) six to eight inches in diameter in about six *weeks.* The structure was at one of the small capes near the entrance to Chesapeake bay.

As the shipworms are gregarious, and furthermore as they grow and multiply with astonishing rapidity, their destructive work is, as shown above, often accomplished in a very short time.

The extent of their operations and the money loss entailed thereby, both upon private parties and business corporations engaged in commercial marine enterprises and on the naval equipment and appurtenances of the great maritime nations, are enormous.

This has led to a great number of experiments by governments and inventors for the protection of wood work used in marine structures.

Jeffreys remarks that "in all probability the constitution of a shipworm is poison-proof." Most of the remedies proposed in the last century were of this nature, and they signally failed.

The saturation or impregnation of the wood with creosote or some other carbolic preparation by hydrostatic pressure, the kyanizing of piles, and sheathing with copper, the filling of the exposed surface with large-headed nails have all been tried. The two last, copper sheathing and scupper nailing, Jeffreys says, "have been successfully used, but the former is expensive and the crust of iron (unless they are closely driven in so as to completely cover the piles) is superficial and liable to scale off. I have known the Teredo to bore through a pile which was supposed to be protected by large broad-headed nails in the usual way. At Christiania, in April, 1863, I found that *Teredo navalis* was very destructive to the woodwork in the harbor, and to boats lying at anchor in the fiord. The chief engineer told me that all the piles had been creosoted (ten pounds to the square foot) before they were driven in, but not to much purpose!"

Certain kinds of wood are less subject to their attacks than others. The tree palmetto of the Southern States, it is said, is never bored by the shipworm, and some of the Australian woods have similar immunity. Dr. Mueller says of the *Eucalyptus marginata* (Smith): "The Jarrah or mahogany tree of S. W. Australia, is famed for its indestructible wood, which is attacked neither by Chelura nor Teredo nor Termites, and therefore so much sought for jetties and other structures exposed to sea water, also for underground work, and largely exported for railway sleepers. Vessels built of this timber have been enabled to do without copper sheathing. It is very strong, of a close grain and slightly oily and resinous nature; it works well, takes a fine finish, and is by shipbuilders here considered superior to either oak, teak or indeed any other wood." * * * The *E. rostrata* (Schlecht), the red gum of Victoria, is another very valuable species for the "extraordinary endurance of the wood underground, and for this reason highly valued for fence-posts, piles and railway sleepers; for the latter it will last a dozen years, and if well selected much longer. It is also extensively used by shipbuilders. * * * Next to the jarrah from S. W. Australia, this is the best wood for resisting the attacks of seaworms and white ants. This species reaches a hundred feet in height."

In some of the seaports in different parts of the world there are small crustaceans that assist the shipworms in cutting away what wood the Teredo may leave. These little fellows resemble the wood-louse (pill bug), and cut either way of the grain of the wood.

In the inlets around Puget sound the destructive action of both classes of animals may be seen, especially about the time of the summer solstice, when the extraordinary fall of the tide exposes the piles (of the wharves) for their entire length. A space measured up and down on the piles for a length of four or five feet, including the portion exposed between *ordinary* tide marks, may be seen which is so completely riddled that it would seem as if the slightest loading of the deck of the wharf would result in a tumble down of the whole.

The wood-eating crustaceans referred to belong to the groups Limnoria and Chelura.

As an offset to the damage caused by these, from point of size insignificant animals, it should be borne in mind, to their credit, that by destroying old wrecks, &c., in channel ways and at the entrance to harbors, they contribute to the safety of navigation.

It is stated also that the operations of the Teredo suggested to Mr. Brunel his method of tunneling the Thames.

THE FLOOD ROCK EXPLOSION.

BY WILLIAM HOSEA BALLOU.

THE greatest artificial earthquake in history occurred on Saturday morning, October 10, at 11 h. 14 m., standard time. The point of disturbance was Flood rock in East river, on the imaginary extension of Ninety-third street of New York city. The earthquake was projected by means of 300,000 pounds of dynamite and rackarock powder arranged in twenty-two miles of metallic cylinders. It was entirely submarine in character, and surface damage was prevented by a tamp of fully 10,000,000 cubic yards of salt water. As a spectacle it was simply an Icelandic or Yellowstone geyser on an extended scale—a sudden rise of water and gaseous smoke to a height of 150 feet for a length of 400 feet and a maximum thickness of 100 feet at the base of the column. The flying rocks and débris sketched in illustrated newspapers are the fickle inventions of inane minds. The column of upheaved water was so enormous that all solid bodies were hidden from vision. The explosion was comparable to a very good earthquake.

Inadequate observations.—Seismological observations were taken at various points, but the arrangements for so doing were inadequate and quite primitive. This is a statement of fact, not reflecting in any manner on the observers. In the first place there were no seismometers or seismographs in this country. In the second place the engineer corps and scientific corps did not act in conjunction with each other, and the latter received no telegraphic warning of the exact moment to expect the shock. In the third place observers were not stationed at sufficient distances from the center of disturbance to measure the length of radii of earth vibrations. Had there been seismographs located at Buffalo, Montreal, Philadelphia, Washington, Portland, Me., far out at sea, or at intervals on a direct diameter, say 1000 miles long, the exact length of the radii might have been determined. Furthermore, seismographs make an intelligible record with the pencil which none of the observers secured.

Results of scientific observations.—The record obtained by the scientific corps, however, was exceedingly interesting and valuable. There were a number of astounding as well as expected results. The instruments used were the seismoscope, the telescope in connection with a horizontal plane of mercury, the sun thermometer, the thermometer, the barometer, the pluviometer, etc.

The shock did not create as much noise as an ordinary field piece.

The shock was felt by the feet and indicated by the seismoscope one-half a second before the result was visible to the eye.

The seismoscope, which is supposed to record the beginning of the shock simply, traced an unintelligible record on the sidereal time cylinder at the Columbia College observatory.

Observers who watched horizontal planes of mercury through telescopes naturally report different results. Professor William Halleck, at Yonkers, N. Y., ten miles from the explosion, records that the vibration of the mercury increased after the first fifteen seconds up to forty seconds, then diminished for ten seconds, ceasing entirely after fifty seconds. Professor J. K. Rees, at the Columbia College observatory, two miles away, and Professor Young, at Princeton, record that the duration of vibration of the mercury was thirty seconds. Professor W. A. Rogers, at Harvard College observatory, 197 miles away, records that the vibrations lasted there two minutes and forty-six seconds. This would show that the earth wave divided constantly as it traveled outward.

All of the instruments of the Central Park observatory left a record very much to the amazement of Professor Daniel Draper and other meteorologists. Why, for instance, should such a disturbance in any way affect the sun thermometer and rain gauge? The former recorded 121° in the sun, when suddenly the pen, which was tracing its record on paper, made a straight mark eight degrees long at right angles with the regular tracing and with four degrees on each side of it. This would naturally show a decrease or increase in the sun's temperature, whereas it was really an interruption of the sun's record by an abnormal cause. Professor Draper thinks that this record must be of great value to seismologists. I think it shows that the record of a sun thermometer, as indicated by a tracing on paper, cannot be relied upon, since any jar is liable to affect it. The pluviometer, or rain gauge, also gave an uncalled-for record of one-eighth of an inch. While these records may be of value to some one who can utilize them, to my mind they only demonstrate the fallacy of placing any value on the record of these instruments as traced on paper.

The atmospheric wave.—The vibrations of the air were exceedingly slight, owing to the heavy tamp of water. The greatest fall of the barometer was .02 of an inch. The wind being in the west and blowing eight miles per hour, the slight atmospheric wave was naturally carried out to sea, so that its duration and extent are lost.

The earth wave.—The velocity of the earth vibrations was one mile in seven-tenths seconds at the outset, decreasing to one mile $\frac{104}{157}$ths seconds, as far as measured. The notated diameter of the shock was 394 miles long. It is safe to approximate the diameters (supposing that observers had been on the watch at sufficient distances) at 800 miles. For if the shock was sufficient to reach the Cambridge observatory, 197 miles distant, in 194 seconds, and shake that eternal structure as it had never been shaken before, it ought to have doubled the distance with some perceptible effect, giving a radius instead of a diameter of 394 miles.

Scientific value of the observations.—The Flood rock explosion cannot be called a surface disturbance because it occurred at the sea level. Volcanic and geyser eruptions vary in altitude and have a vibratory power downward. All of the vibratory power at Flood rock was upward, which makes its effect all the more wonderful, since the farther the shock traveled the more of the earth surface it had to lift on account of the constant rise above sea level. Enough explosives were used to have obliterated Manhattan island if placed on the surface, or to have leveled Mt. Washington. The fact that 300,000 pounds of explosives will affect a surface of 300,000 square miles does not necessarily settle the question as to the cause of earthquakes. It does not verify the belief that explosions of some kind cause earthquakes, but leaves us in the dark as to the composition of such explosives. What mighty ingredients combined to lift the bowels of Krakatoa five and ten miles in the air, and so envelope the whole globe in a nebula of dust that the sun turned green and the sunsets were framed in gorgeous hues, lighting up the night long after the orb had disappeared? What mighty ingredients combined to explode Java and overwhelm 100,000 people? What chemicals combine beneath the Yellowstone park and hurl the boiling waters from Old Faithful geyser every hour, from the Minute Man once per minute, from clusters of geysers all at once every day at 4 P. M., from Hell's Half Acre once per year or so, when this huge basin all boils up at once in one immense cauldron of seething waters? Flood rock answers these questions in part. It says that explosions of some kind do the work; but this answer only opens the door and points to a sea of data yet to be secured as to the nature, component parts and *modus operandi* of these explosions, which differ evidently in different cases.

Note.—The seismological observations to determine the duration and extent of the earth and atmospheric waves were taken on two lines running at right angles with each other. General Henry L. Abbot, of the United States Corps of Engineers, had charge of the observatories on an east and west line on Long Island, with headquarters at Willet's point. The north and south line was in charge of Professor F. W. Clarke, of the United States Geological Survey, Washington. He had his southern station on Staten island, in charge of Professor H. M. Paul of the United States Naval observatory. At the next station, on Ward's island, Professor T. C. Mendenhall, of the United States Signal Service, and himself observed. At Yonkers Professor William Hallock, of the United States Geological Survey, and student Thomas Ewing, Jr., of Columbia College, occupied a station. The most northerly observatory of the chain was at Vassar College, in charge of Professor Maria Mitchell. Dr. Daniel Draper took observations on a number of instruments at Central park. The astronomers at Princeton, Harvard and Rutgers colleges also made observations in conjunction with the others.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

—— It is safe to say that the greatest necessity of scientific progress in the United States to-day is schools and academies of original research. We have colleges and universities enough in most of the States, but there has not yet been established a single school where knowledge is produced, which corresponds in scope with the numerous institutions where it is taught. Perhaps it is a general impression that there is already more knowledge in the world than can be learned; but, if this be true, it can not for a moment obscure the greater truth, that most of the laws of nature remain still, more or less, unknown. It is, or ought to be, well known, that all the knowledge taught in the schools is the product of original research, and that all books of any value in libraries, excepting works of the imagination, are derived from the same source. Hence, it appears that the absence of schools of research is a phenomenon for which it is difficult to account. There are some schools of this kind which cover a limited part of the field of knowledge, such as the summer schools of biology on the coast; and there are some museums where a limited amount of research is conducted, as much as their financial and intellectual resources permit. But these institutions are either so limited in means, or so completely under the control of non-investigators, that they are ineffective at present, or offer no prospect of progression in the future.

If any public-spirited citizen desires to erect for himself a unique and enduring monument, such can not be more effectively and usefully done than by the endowment of an Academy of Original Research. Such an institution would be a perpetual spring and source of knowledge and truth, and a living "nucleus" in the great organic body of society.

An institution which should cover most of the ground might be organized on the following basis: Six departments might be established, namely: 1, Astronomy; 2, Physics; 3, Chemistry; 4, Geology; 5, Vegetable Biology; 6, Animal Biology. For each of these departments the annual expenses would be as follows:

For salary of director	$3,500
For salary of assistant	1,000
For material (apparatus and specimens)	3,500
For books	500
	$8,500

which is, for the six departments, $51,000. Then there should be $7,000 per annum for publications, leaving $2,000 for janitor and other necessary expenses. The total income of $60,000 represents an endowment of $1,000,000. Of course, the details might be varied according to probable necessities, etc. And for a smaller endowment, fewer departments might be created, but not without seriously crippling the institution. Various details, such as the boundaries of the departments, the duties of assistants, etc., would have to be fixed. A certain number of lectures should be given by the directors, which should serve as an index of the characteristics of the workers and their work.

In the selection of the men who should act as directors of the departments, the principal difficulty is to be encountered. The enterprise of the American is no less marked in the struggle for place and reputation, than in the struggle for the almighty dollar. Qualification is little thought of by too many persons, who from physical or mental weakness, or some other cause, desire to live without labor. The charter of an institution of research should embrace a provision, that the position of director should be forfeited by that one who should not produce some original work of merit every year or two, or during some other definite time. In no other way could the institution be preserved from the intellectual decay into which so many have fallen; and in no other way could it be protected from patrons whose kind intentions might include personal favorites unknown to scientific research. Men of money who desire to sustain original research will be compelled to devote some inquiry as to who are the men who are loyal to this work. The best index they can find to this class is the record of their work already done.

The best mode of government of such an institution would be by a senatus composed of the six directors of the departments and an equal number of trustees of the endowment. In this way the greatest amount of wisdom would be brought to bear on the two questions of administration, viz.: the preservation of the fund, and the manner of its expenditure.—*C.*

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RECENT LITERATURE.

THE UNPAIRED FINS OF SELACHIANS.[1]—Dr. Paul Mayer, under the above caption, discusses the median fins of Selachians and throws new light upon a number of morphological questions which have lately arisen. He carries Dohrn's conclusions still farther, and has actually discovered at the end of the tail and on the back of the young embryo of Pristiurus and of Scyllium homogeneous structures (Hautknöpfe) of subepiblastic origin, of the same substance as the horn-fibers or actinotrichia in the fin-folds. These button-like structures are found on the back of the embryo, in a single row, on either side of the median line and in advance of the permanent dorsal. At the end of the tail they are in two rows, viz., a dorsal and a ventral series. In both situations they are metameric in position, and sections show that temporary muscular buds are thrust outward towards these singular lateral larval organs from the muscular segments or myotomes in the same way as to the bundles of fibers or actinotrichia representing rays in the median and paired fins.

These remarkable organs Mayer regards as the vestiges or remnants of parapodia, and therefore names them *parapodoids.*

[1] *Die unpaaren Flossen der Selachier.* Mitt. Zool. Stat. zu Neapel. VI, pp. 217–285, pl. 15–19. 1885.

At the tip of the tail they stand in the position of the caudal neuropodia and notopodia of errant annelids, but are not, as in them, constituted of palea, bristles, etc. In the anterior dorsal region of Scyllium, these bodies are in the position of neuropodia.

It will thus be seen that Mayer supplies a most important set of data which lend support to the views of Dohrn as to the meaning and origin of the median and paired fins, since that author has contended that the relations of these peripheral structures to the axis of the body are to be determined by the relations they bear to the myotomes which send out muscular buds into the fins, and not on the basis of the relations to the cartilaginous appendicular skeleton or spines, as held by most other morphologists.

The table which Dr. Mayer gives to illustrate the varying relations of the same metameric elements of the median fins to the point where the vertebral axis becomes diplospondylic are also of great interest, not only morphologically, but also taxonomically. For the first time in the history of the subject, in fact, we have presented in this paper a tabulated statement of what are the actual relations of the metameric elements of the vertical fins to the myotomes of the body and the sclerotomes and nerve-pairs of the axis in the principal families of Elasmobranchii. The paper also illustrates the perfection and resources of modern biological methods. It is to be regretted that the author does not give a brief summary of his results at the close of the paper.

These researches, it may be remarked in conclusion, also show that in Scyllium there is developed a posterior terminal, vermiform section of the embryo which corresponds to what the writer has called an opisthure. Though it is obvious that this opisthure is rudimentary and evanescent, as it soon becomes inconspicuous. Some of the Elasmobranchii, therefore, pass through what the writer has termed an archicercal stage.

The results reached by Dr. Mayer also afford important evidence in support of the archistome theory, published by the writer in this journal recently.[1]—*John A. Ryder.*

Bower and Vines' Practical Botany.[2]—One of the significant signs of the times, so far as botany is concerned, is the multiplication of books which are designed to encourage the practical study of plants in the microscopical and physiological laboratories. A few years ago, such a thing as a laboratory manual for the guidance of the botanical student was unheard of; now we

[1] American Naturalist, November, 1885, pp. 1115–1121.

[2] *A Course of Practical Instruction in Botany.* By F. O. Bower, M.A., F.L.S., Lecturer on Botany at the Normal School of Science, South Kensington; and Sidney H. Vines, M.A., D.Sc., F.L.S., Fellow and Lecturer of Christ's College, Cambridge, and Reader in Botany in the University. With a preface by W. T. Thistleton Dyer, M.A., C.M.G., F.R.S., F.L.S., Assistant Director of the Royal Gardens, Kew. Part 1., Phanerogamæ–Pteridophyta. London, Macmillan & Co., 1885.

have half a dozen or more, each giving valuable and needed help to the young investigator. The latest of these manuals is the one now before us.

The book, we are told in the preface, is the outgrowth of work done in the Normal School of Science at South Kensington, during several years under Mr. Dyer, and afterwards to the present under Mr. Bower. Originating in this way, the book is not open to the objection of impracticability which so frequently may be brought against works of this kind, and the beginner may take it up with confidence that he is not asked to undertake that which for him is still impossible. A book which has *grown* into being is always helpful, and this will prove no exception to the rule.

There are in the beginning of the book a couple of introductory chapters in which are discussed briefly, and yet satisfactorily, the making of preparations—micro-chemical reagents, the general structure of the cell, the micro-chemistry and the micro-physics of the cell. Altogether, fifty-three pages are given to the foregoing topics.

In the succeeding pages are taken up first the Phanerogams and afterwards the Pteridophytes. The sunflower (*Helianthus annuus*) is taken very properly as the representative of the herbaceous, dicotyledonous angiosperms. This is followed by a study of the arboreal type represented by the elm (*Ulmus campestris*). The monocotyledons are principally represented by Indian corn (*Zea mais*). In the Gymnosperms the Scotch pine (*Pinus sylvestris*) is used for study. In each case, stem, leaf, root, flower and embryo are successively taken up and carefully studied. The same method is followed in the Pteridophytes, where Selaginella, Lycopodium, Aspidium and Equisetum represent the different types of structure.

The general plan of the work is the same as that of Huxley and Martin's well-known book, "Practical Instruction in Elementary Biology," and the faults of the present work are identical, as appear to us, with those of its forerunner. While such books are very useful, and while they are doubtless doing much to stimulate better work, we have long been of the opinion that altogether too much help is given in them to the pupil, and that he is not thrown often enough upon his own resources. It is true, of course, that in the laboratories of many teachers, books of this kind will not be used in such a way as to work to the disadvantage of the pupil, but in many other cases—in too many cases—they will be. In making these strictures upon the book, we would not be understood as criticising the method of study of which it is the outgrowth. As to that there can be but one opinion; but unless great care be taken by the teacher and pupil, the results originally obtained at South Kensington without the book will not be secured with it. The book must be used as a *general guide*, and must not be blindly followed paragraph by paragraph and page by page. Its proper function is *suggestive*, and, if so used, it will prove of great value in the botanical laboratory.

We cannot omit commending the form which the publishers have given the book. The type, printing, paper and binding are excellent, the flexible covers being especially commendable.—*Charles E. Bessey.*

TORREY'S BIRDS IN THE BUSH.[1]—This is a dangerous little book. Young naturalists who have chosen paths that are not those of song and color should avoid it, lest they also should, by its winsome sweetness, be charmed to become ornithologists. Birds appeal to other faculties beside those of the intellect. The musician, the poet, the painter, all find inspiration in the *oscines*. Perhaps this is the reason there is so much twaddle written about birds. Since there is an audience writers devoid of the artistic, poetical, or musical faculties pen a series of quasi-scientific meanderings, and send it forth as a bird-book. But Mr. Torrey loves bird-song and bird-beauty and tells his love in language remarkable for force and picturesqueness. The eleven chapters teem with the result of years of life among the birds, and the author has a quaint way of comparing bird-life and bird-ways with our own life and ways, without allowing the reader to forget that it is only a bird he is talking about. No heavier blow has been dealt the sparrow-hater than that given in the first chapter of this book. Though by no means a sparrow-lover, Mr. Torrey confesses that, in the space of the last seven oreight years, he has watched upon Boston Garden and Common some thousands of specimens, representing not far from seventy species. The author owns to the true aboriginal temperament—he loves to be out of doors, but hates out-of-door employment; this is the stuff ornithologists should be made of, plus eyes.

LOUIS AGASSIZ; HIS LIFE AND CORRESPONDENCE.[2]—The story of Agassiz's life, as here told, is an exceedingly attractive one, and we wish that a cheap edition of it could be published for the benefit of the youth of our country. The materials have been put together with much literary skill and judgment, the letters forming the larger part of the materials for the biography. To the American student who knew Agassiz, the first volume, relating to his boyhood, his youth at the universities, his early manhood as a collector and investigator, his life as a professor at Neuchatel, his correspondence with Humboldt, his nine summers spent in Alpine exploration—this volume will seem like a romance. To those who never saw this child of genius, the second volume, recounting his successful life in America, the land of his adoption, will be full of interest.

[1] *Birds in the Bush.* By BRADFORD TORREY. Boston, Houghton, Mifflin & Co.

[2] *Louis Agassiz—His Life and Correspondence.* Edited by ELIZABETH CARY AGASSIZ. Two volumes. Boston, Houghton, Mifflin & Co., 1885. 12mo. $4.

As a youth, Agassiz was indefatigable as a collector, personally attractive, full of high impulses, and his whole mind pervaded with the scientific spirit. His early dreams were fully realized; his castles in the air were actually built—he laid their foundations and saw the superstructures materialized in richly illustrated volumes and in brick and iron. The vast collections—the results of his journeys, of his passionate appeals to State and individuals, the unsolicited funds which flowed in as the meed of his success in winning the confidence and sympathy of scientific and lay men—these fill the Museum of Comparative Zoölogy, that monument of a life of rare devotion to high ideals.

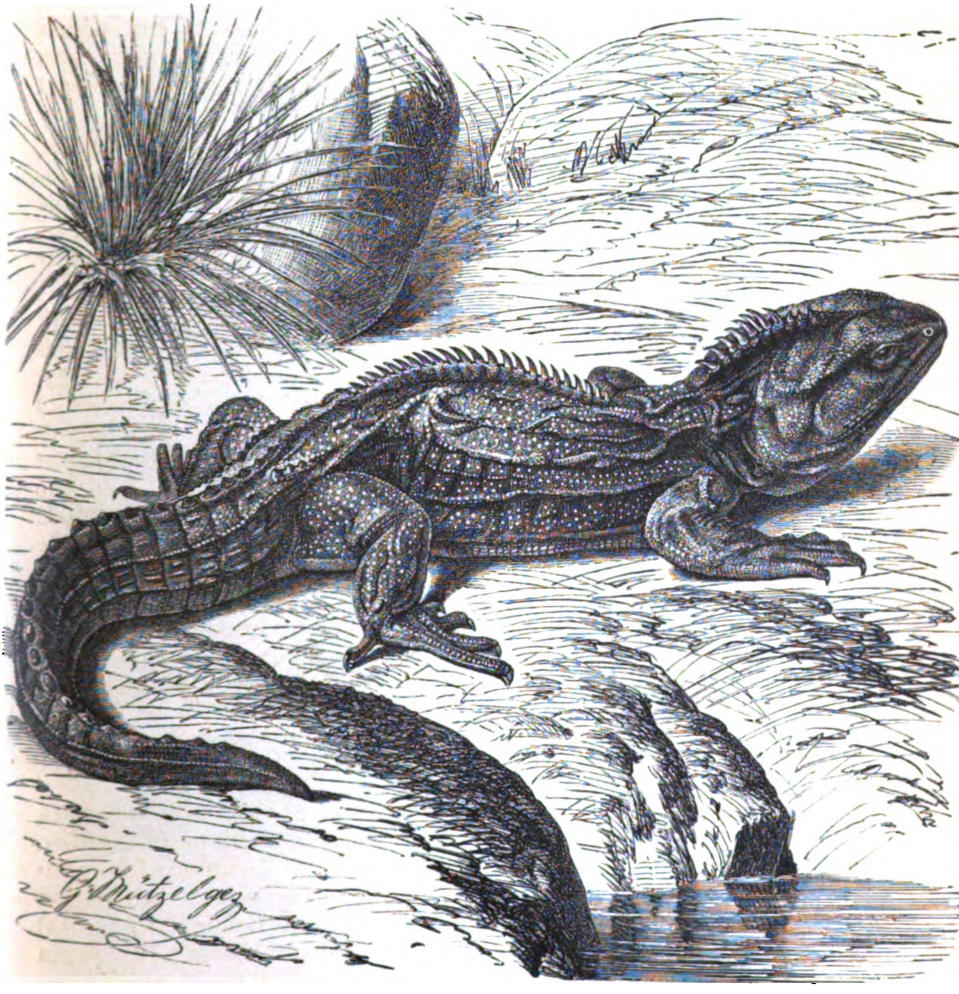
Agassiz was a genius. Winning in manner to an unusual degree, full of ardor and enthusiasm, often reckless, but always successful, with a grain of fanaticism and one-sidedness in his nature, like a knight of old he won his proud position as one of the leading scientific men of his age and the most influential and popular teacher in the New World.

Agassiz had great powers of generalization, side by side with those of acquisitiveness, of facts and specimens. His investigations in embryology, palæontology, as well as systematic zoölogy, led him to form clear views as to the geological succession of animals, the parallelism between the development of the individual and the group to which it belongs. His mode of looking at nature, the whole drift of his teachings, naturally prepared the mind for the reception of evolutionary ideas, and while his pupils and his contemporaries advanced naturally to these philosophic conceptions or generalizations, Agassiz,—whether owing to early prejudice, the lack of a judicial turn of mind and analytical powers, the modicum of combativeness and bigotry in his strong, intense nature, or the multiplicity of his labors and cares in the later years of his life, which gave him little time for sustained thought,—failed to rise to the grand generalizations of modern biology. He will be known in the history of science as the strongest opponent, after Cuvier, of the theory of descent.

Our Living World.—This work, now publishing in numbers, is, in the language of the title-page, an artistic edition of the Rev. J. G. Wood's Natural History of the Animal Creation. It is published by Selmar Hess, of New York, and edited for distribution in this country by Dr. J. B. Holder. The parts before us (27 to 32) finish the birds, discuss the reptiles and batrachians, and begin the account of the fishes. As will be seen by the samples illustrating this notice, the illustrations, which are mostly taken from Brehm's Thierleben, are very superior to any elsewhere printed, and give much value to the work.

The oleographs are also copies, by Mr. Prang, of those in Brehm's popular work. We should like to have had the remarkable characteristics of the New Zealand Sphenodon given. As it is

PLATE VIII.



The Sphenodon of New Zealand.

PLATE IX.

The Gannet.

it is regarded simply as the type of a family of ordinary lizards, whereas, by the best authorities, the group Rynchocephalia is regarded as a distinct order of reptiles of very primitive structure.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

ASIA—*The Rivers of the Punjab.*—An account of the rivers of the Punjab, by Gen. R. Macagan, occupies the first place in the November issue of the Proceedings of the Royal Geographical Society. Though Punjab means "five waters," the more ancient name was the land of the seven rivers, the Indus on the one side, and the Saraswati on the other, being added to the Jhelum, Chenab, Ravi, Beás, and Sutlej. The Saraswati rises in the low outer hills of the Himalayan mountains, and is now an unimportant river, except in the season of flood, yet it is described in the ancient writings of the Hindus as a mighty river like the others. But the Punjab was the tract first occupied by the Aryan immigrants from the north, and it appears more probable that the ideas of the people concerning the river changed when they knew it

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

better, and had advanced to the Jumna and the Ganges, than that the river should have altered so greatly. Yet the disappearance of the forests marks some diminution in the water-supply. Later writings, about the sixth century B. C., state that the Saraswati sinks into the earth, and gives the Ganges and Jumna at their confluence. This is probably a fable to save the credit of a sacred river. The Sutlej and the Indus rise on opposite sides of Mount Kailas, at elevations of about 15,200 and 18,000 feet respectively, and both flow north-west for a considerable distance, and then turn to the south-west, the Indus taking the wider sweep, and enclosing, between itself and the Sutlej, a broad tract containing the other four rivers and their drainage basins. Much of the upper courses of all these rivers is torrential, but the Indus runs with a gentle and winding current through Ladak at a height of 11,000 feet, and the lovely valley of Kashmir is situated near the sources of the Jhelum, which is even there a large river, since several tributaries join at Islamabad, forty miles above Srinagar. At Baramula, the Jhelum leaves Kashmir, and falls thirty-five feet per mile for seventy-five miles, and then twenty-one feet per mile to the Punjab plains. The earliest of the metrical histories of Kashmir state that the valley was once a lake, and that a powerful sage cut the gap at Baramula. It is not impossible that it was the work of man. Seventy-five miles of the upper course of the Beas have a fall of 125 feet per mile. The courses of all these rivers after reaching the plains of the Punjab are, like those of the Mississippi and other rivers which have flood plains, subject to much disastrous change. The rainfall of the higher portions of the Punjab, where the rivers leave the hills, varies from thirty-four to forty-eight inches. At fifty miles from the hills only sixteen to twenty-four inches of rain falls, and at 100 miles, but ten to twelve inches. Where the rivers unite, no more than six inches of rain falls annually, and still less than this visits the desert plain of Sind, through which the mighty Indus, after receiving the five rivers, flows to the ocean. The five rivers unite before reaching the Indus, and the united stream, called the *Panj-nad*, or five streams, is at the junction more than twice the width of the Indus, but much shallower. The discharge of the Panj-nad at the low season, is estimated at 69,000 cubic feet per second, that of the Indus at 92,000. The flood discharge below the junction is about 380,000 cubic feet. A very large amount of water borne down by these rivers sinks into the ground, and forms an underground reserve of water, which even in the rainless region round near the meeting of the five rivers is not more than twenty-four feet below the surface.

Some Himalayan Peaks.—According to notes communicated by Lieut. Col. H. C. B. Tanner to the British Association, there are no large glaciers on the north-east or shady side of Kinchinjinga, nor does Mt. Everest seem to have noteworthy glaciers. Kabru is really a snow-clad table-land 24,000 feet high. Observations of Mt. Everest have to be taken from a distance of eighty miles, on account of the jealousy of the Nepalese government. As it is surrounded by peaks not greatly inferior in height, its aspect is not imposing, and the Tibetans look upon some other peak to the north or north-west as higher. The following table, given by Col. Tanner, shows the height above the sea of some of the highest Himalayan peaks, as well as the height of slope actually exposed to view.

	Height.	Height of slope exposed.
Everest (or Gaurisankar)	29,000	8,000
K² (Kashmir boundary)	28,278	
Makalu (No. XIII)	27,800	8–9,000
Nanga Parbat	26,600	23,000
Tirach Mir (Hindu Kush)	25,400	17–18,000
Rakaposhi (Gilgit)	25,560	18,000
Kinchinjinga	28,160	16,000

Mont Blanc, though only 15,781 feet high, presents a face of 11,500 feet.

M. Potaneri's Journey.—M. Potaneri has made interesting discoveries in Northwest China. The broad valley of the Tchitai, a tributary of the Hoang-ho, is thickly peopled by Salars (Turcomans), its upper part by Tanguts. The right bank of the Hoang-ho itself, near San-chuan, is also peopled by Salars. They maintain their Turkish language, and the Mussulman religion, but their mosques are Chinese in style, and the men wear a Chinese dress. The women wear broad trousers, an overcoat with sleeves, and a pointed bonnet. Above the gorge near San-chuan (excavated in the red sandstone and conglomerates which underlie the Loess), is a depression seven miles long, peopled exclusively by Mongolian Shirongols, who seem to belong to the same stem as the Dalda of Lake Kuku-nor. The Chinese call both Tu-jen. They speak Mongolian, with some Chinese words, and dress like Chinese, but the women wear trousers like the Salar women. Around He-cheu they are Mussulmans, but Buddhism and the teachings of Confucius are followed by some.

Asiatic News.—M. Ivanoff has recently described in the *Izvestia*, the remains of Akhyr-tash, at the foot of the Alexander range in Turkestan. The area covered by the remains is 20,900 square yards, and the stones weigh each about a ton. Some stone idols and a burial-ground on the Tssyk-tul are also described. ——The Kampti villages on a tributary of the Irawadi, visited by Wilcox, sixty years ago, have again been visited by Col. Woodthorpe. Only a very ordinary road is required to open up a trade with these people from Assam.——Mr. Gardner considers Mukden, the capital of the Mongolian province of Fêng-Tieng, as one of the finest and most prosperous cities of the Chinese empire. The population of the province is chiefly Chinese. In 1865 it was a neutral belt, which neither Chinese nor Coreans were allowed to colonize. Since 1876 hundreds of thousands of emigrants have arrived from Shantung and Chihli, and have broken up and cultivated land on both sides of the Great Wall or Palisades. The site of Newchang, the port of Fêng-Tieng, was in the seabed up to the beginning of this century. The province of Korin contains a large community of Coreans.——About 48,000 square miles, or 5½ per cent of British India, has been reserved as forests. Some are upon the plains or on the low ranges of hills rising from them, some on the lower or middle slopes of the Himalayas to an elevation of 8000 to 9000 feet. A forest survey is in progress, largely in the lands of native surveyors trained in the Forest Survey Department. A school of Indian forestry has been established, in which natives are trained to be conservators and rangers.

AMERICA.—*The Claims of France in Brazil.*—M. Condreau calls attention in a recent issue of the *Revue Scientifique* to the undetermined portion of French Guiana. Upon maps the river Oyapock is shown as the south-eastern boundary of French Guiana, separating it from Brazil, while the southern boundary is formed by the Tumac-Humac mountains. It appears, however, that France has at various times occupied and abandoned the territories between the Oyapock and the Amazons, and that the peoples of that region live actually independent of either Brazil or France. M. Condreau states that Brazil once offered to divide this territory, but that France claimed two-thirds. In any case, the country in dispute is worth having, since it is not an unhealthy marsh like Guiana itself, but an elevated healthy prairie country tilled for colonization. The region offered to France in 1856, between the Oyapock and the Carsevesme, is as large as three French departments; while that claimed by France, ending at the Tartarougal, contains twice the area.

M. Condreau argues for the acceptance of the Brazilian proposition. Arguments about rights make it clear to a Frenchman that France ought to own all the country north of the Amazon as far as the Rio Negro, and equally clear to a Brazilian that Brazil owns to the Oyapock. Diplomacy has tried to settle the matter for two hundred years. Most of this territory has been settled by Brazilians, but the coast and prairies back of it are occupied only by Indians. He proposes a Franco-Brazilian commission to settle the matter. The first need is a good map. The seaboard is subject to continual change, especially between the Mapa and Cabo Rase de Norte. During the last forty years much alluvial land has been made by the rivers. Of the interior country, and of the Island of Maraca next to nothing is really known.

American News.— Lieutenant Cantwell has explored the river Putnam to its source, 520 miles from the mouth. It rises in four large lakes; the largest is about 153° W. long. and 67° N. lat.

He found that there was an easy communication between Kotzebue sound and the Yukon.——Mr. B. McLenegan, with one sailor, ascended in a canoe the river Nortauk, which enters the Arctic ocean at Hotham inlet, for a distance of 400 miles. Here one of the head streams of the river issued from a small lake. No inhabitants were met with. The course of the Nortauk is entirely in the Polar circle, and the lake in which it rises is the most northerly inland point yet reached by white men in Alaska.——A rich deposit of coal of good quality has been found at Cape Lisburne (69° 37′ N. lat.).——From the observations made by the *Alert*, it appears that Hudson's bay and strait are navigable from July to October, and that the climate of the Hudson's bay coast is less severe than that of Northwest Canada.——Lieut. Allen has returned to San Francisco from an exploration of the Copper river, which he ascended as far as the mountain range of Alaska. He then crossed the mountains on snow-shoes, and reached the sources of the Tennah, which he followed 800 miles to its junction with the Takon. The latter he descended to its mouth, a distance of 400 to 500 miles.——M. Thonar has left Buenos Ayres to complete his explorations on the Pilcomayo.——Captain L. Gray found, during his visit to the east coast of Greenland last summer, that the land ice was sufficiently open in August to afford passage for a steamer. He sailed along the coast from Shannon island to the entrance of Scoresby sound.——J. Hughes and F. Dunsmuir have returned to Juneau, Alaska, from the headwaters of the Yukon. Good placers were found, mostly in British territory.——The governments of the Argentine confederation and of Brazil have agreed to a joint exploration of the neutral or disputed ground on the western limit of the Brazilian province of Sta. Cateria, situated between the Uruguay and Iguassu rivers. An old treaty between Spain and Portugal fixed upon two rivers, the Peperi and San Antonio, the first flowing into the Iguassu, the second southward to the Uruguay, as the boundary; but the difficulty is to identify the rivers so called in the treaty.——Lieut. Greely, in a recent lecture at Dundee, stated that the temperature observations taken during his stay in Grinnell sound confirmed the expectation that it had the lowest mean temperature known, about 4° F. below zero. The discovery of coal at various points showed how climate had changed. He doubted the existence of a palæocrystic sea. The floe bergs from 100 to 1000 feet thick, are, in his belief, detachments of slowly moving ice-caps from a land near the pole. In Kane sea he visited a floe berg a third of a mile wide and a fifth to a sixth of a mile thick, and found upon it two valleys thirty feet deep, along which were fully 100 large stones polished and worn smooth—proofs of the glacial and terrestrial origin of the floe.

Africa.—*Capello and Ivens' Journey.*—Messrs. Capello and Ivens reached Lisbon on Sept. 17th, after traveling 4200 geographical miles in Africa during fifteen months. From the Portuguese territory they proceeded towards the Cubango, as far as the lower part of the Tucussu, where the barrenness of the region, intersected by water-courses and marshes, forced them to turn northwards through a district infested by the tsetse. Sixteen of the party died of tsetse-bites, besides cattle and dogs. Sixty-two men perished during the fifteen months. The principal results of this journey are the rectification of the course of the Cunene, the determination of the Quarrai and its union with the Cubango, as well as the interesting hydrography of the Handa and the Upper Ovampe; the exploration of the Cubango between 15° and 17° S. lat., and of its principal eastern affluents; the investigation of the basin of the Upper Zambezi to Libonta, and the upper and middle course of the Cabompo; the discovery of the Cambai, an eastern branch of the Upper Zambezi; the exploration of the sources of the Lualaba and Luapula, and of the northern tributaries of the Middle Zambezi; and the identification of the Lœngue with the Kafuke. The great lake Bangweolo of modern maps is really composed of two smaller lakes, Bangweolo to the north, and Bemba to the south, separated by a marshy belt. This agrees with M. Giraud's account.

GEOLOGY AND PALÆONTOLOGY.

The Sternum of the Dinosauria.—The discussion which has been going on between palæontologists, as to the nature of the sternum of the Dinosauria, and the presence or absence of clavicles in this order, induces me to present some evidence which bears distinctly on the question. The first point to be noticed is the pair of bones represented in Fig. 1, which belongs to the skeleton of *Diclonius mirabilis* Leidy.[1] It is evident that these resemble very nearly the parts discovered by Dollo in the *Iguanodon bernissartensis*, in place, and referred by him to the sternum.[2] Not having been present at the exhumation of the Diclonius, I cannot give their exact relations. The positions in which the bones were found by Dollo in the Iguanodon renders it highly probable that they are the separate pleurosteal elements of the sternum. The long processes will then be posterior, and will have given attachment to ribs. Such a type of sternum is, however, unique, and requires good evidence before admission into our descriptions.

Important evidence on this point is furnished by the probable corresponding element in the Laramie dinosaurian, the *Monoclonius crassus* Cope.[3] This is a quadrupedal form, about as large

[1] Proceedings Academy, Philadelphia, 1883, p. 97.

[2] Bulletin du Musée Royal d'Histoire Naturelle de Belgique, 1882, p. 208.

[3] Proceedings Academy, Philadelphia, 1876, October; Pal. Bulletin, No. 22, p. 8.

as a *Rhinocerus unicornis*, with teeth approaching those of Hadrosaurus in characters. The accompanying figure 2 represents the element in question, one-tenth the natural size. Here the lateral elements are united on the middle line, which projects as an obtuse keel. The lateral processes are nearly transverse, and are impressed at their extremities by articular surfaces. The opposite extremity presents a facet on each side for a squamosal articulation with a flat bone (*c*, Fig. 2), in which the inferior bounding ridge projects much further than the superior one. This articulation cannot be for any other bone than the coracoid, and it resembles considerably the corresponding groove on the sternum of the crocodile. The general surface of the bone is dense, and does not resemble the imperfect ossification described by Hulke in the bone of similar character referred by him to

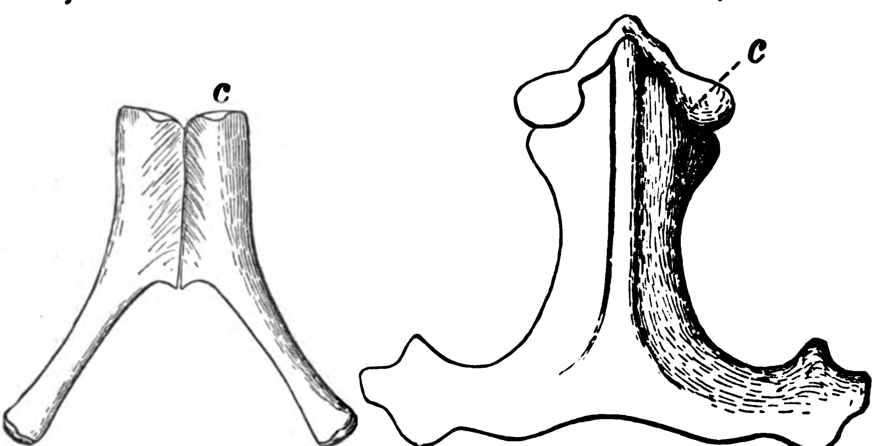


Fig. 1. Fig. 2.

FIG. 1, Sternum of *Diclonius mirabilis* Leidy ; FIG. 2, do. of *Monoclonius crassus* Cope; both one-tenth natural size; *c*, coracoid facet. From the Laramie beds of Dakota and Montana.

Iguanodon.[1] That the element in Monoclonius, represented in Fig. 2, is the sternum, seems very probable, and, if so, the elements in Diclonius (Fig. 1) are sternum also.

The T-shaped bone figured by Hulke, if inverted, would resemble the elements here referred to the sternum in Diclonius and Monoclonius. Mr. Hulke describes a probable articular facet along its sides "posterior" (anterior) to the divergent bars, as suggesting an articulation with an epicoracoid. This may correspond with the facet *c* in Diclonius and Monoclonius, which, I suppose, received the edge of the coracoid. This justifies the proposition of Baur,[2] that this bone should be inverted, and that the supposed clavicles of Hulke and Marsh are posterior pro-

[1] Quarterly Journal Geological Society, 1885, pl. XIV.
[2] Zoologischer Anzeiger, No. 205, 1885, p. 2.

cesses of the sternum and not anterior. The evidence for this position rests primarily, I repeat, on the position of the bones observed by Dollo, and the character of the corresponding element in Monoclonius.

But it may be that the bone figured by Hulke is a different element from that figured by Dollo, as supposed by the latter.[1]

The proximal end of the scapula of *Diclonius mirabilis* resembles very much that which I have figured and described as belonging to *Hadrosaurus foulkei*,[2] excepting that it possesses a strong tuberosity on the anterior border (*spina scapulæ*), which is wanting in that species. It is represented as weak in the two species of Iguanodon by Dollo, and as rather strong in the same genus by Hulke.—*E. D. Cope.*

Corrections of Notes on Dinocerata.—In the Naturalist for June, 1885, I gave a synopsis of the genera of this suborder, which was partly based on new information derived from Professor Marsh's work, then recently published. Among them was included the supposed genus Tetheopsis, whose character consisted in the absence of inferior canine and incisor teeth. The discovery of species presenting such a peculiarity would not be at all surprising in view of the reduction which the roots of these teeth display in some of the species, and the absence of superior incisors in all of them. The character on which the genus was predicated is figured by Professor Marsh in the skull referred to *Tinoceras stenops* Marsh, without comment in the description which follows. I now learn on good authority that the symphyseal region in the specimen in question is entirely constructed of plaster of Paris. I saw the specimen, and a rather close examination did not reveal the line of separation between the plaster and the bone, which it is colored to imitate, and which is not indicated in either Professor Marsh's figures or description. The genus Tetheopsis must then be regarded as an artifact!

I add that the basal part of a skull which I described under the head of *Uintatherium lacustre* Marsh (U. S. Geological Survey, Terrs., III, p. 592) turns out to belong to a Palæosyops. The skull was found in a broken condition mingled with loose fragments and teeth of the Uintatherium in such a way as to lead to the belief that they belonged together.—*E. D. Cope.*

Discovery of lamellate thoracic Feet in the Phyllocarida.—In a genus of Phyllocarida, allied to Ceratiocaris, which is represented by a specimen from the Carboniferous beds of Mazon creek, Illinois, kindly loaned me by Mr. J. C. Carr, of Morris, Ill., there are plain indications of broad lamellate feet like the thoracic feet of Nebalia.

Of these limbs there are traces of four pairs. They are broad

[1] Revue des Questions Scientifiques, 1885, p. 8, top.
[2] Transactions American Philosophical Society, 1869, XIV, p. 92.

and thin, slightly contracted in width near the base, and at the distal extremity quite regularly rounded, with the free ends apparently slightly folded longitudinally, the edges appearing to be slightly crenulated, though the folds were perhaps due to changes after death. All the feet are of nearly the same size, and are about two-thirds as long as the carapace is high, being of nearly the same proportionate length as in Nebalia. There are no traces of a division into endopodites and exopodites, but we should be inclined to regard the parts preserved as the homologues of the exopodites of Nebalia.

This specimen, then, indicates the existence in extinct Phyllocarida of thin, broad, lamellate, thoracic limbs, in general appearance like those existing in Nebalia, and should this view be substantiated by farther discoveries it will prove the reasonableness of uniting Ceratiocaris and its allies with the modern Nebalia. I had a year ago considered this form as new and gave it a MS. name *Cryptozoë problematicas*, as I was in doubt as to its affinities; but lately submitting it to Mr. C. E. Beecher, with the opinion that it was a Ceratiocaris, he writes me that he regards it as new to science. A description of the new genus and species, with figures, will appear hereafter.—*A. S. Packard.*

Geological Survey of Pennsylvania.—Report of Progress x contains a geological hand-atlas of the sixty-seven counties of Pennsylvania, and is the work of J. P. Lesley, the chief of the survey. The volume is one which ought to be in the hands of every one interested in field geology, embodying as it does, in convenient form, the entire results of the survey, so far as they can be cartographically represented. The maps are prefaced by an explanation of the geological structure of Pennsylvania, and a short account of the characteristic features of each county.

Geological Survey of Minnesota.—Professor Winchell's Twelfth Annual Report commences with a summary statement of work done. From this it appears that maps of thirty-two counties are completed, and several others in course of preparation. A new trilobite of the genus Bathyurus is described. Professor Winchell gives an account of experiments with cubes of New England and Minnesota granites, and seems to prove the latter to be the stronger.

C. L. Herrick contributes a final report on the Crustacea of Minnesota (Cladocera and Copepoda). This occupies 191 pages, includes an account of the enemies of entomostræa, and appears to be exhaustive. It is illustrated with numerous plates. The volume concludes with a catalogue of the flora, by Warren Upham. It includes 1650 species, comprising vascular cryptogams, but not fungi or algæ.

Geological News.—*General.*—A. S. Woodward (*Geol. Mag*, Nov., 1885) gives a list of the British fossil Crocodilia. One species occurs in the Upper Trias, six in the Upper Lias, thirty-nine from the other Jurassic beds, eleven from the Purbeck and Wealden beds, three from the green sand, and six from the Eocene.

Silurian.—Dr. O. Hermann (*Geol. Mag.* Sept., Oct., 1885) gives an account of the organization of the Graptolithidæ. The entire polypidom proceeds from a simple hollow cone called the *sicula.* In the external wall of this dagger-shaped organ a single or double solid axis is developed. Thus, until the sicula is found, it is impossible to tell whether any given form belongs to the monograptidæ or to a two-branched family. Sprouting does not always commence at the same spot of the sicula. It is now assumed that all graptolites provided with a sicula were not attached bodies, the character of the termination, and its disappearance in full-grown individuals, militating against attachment. In some of the much-branched Dichograptidæ a central chitinous disc unites the basal part of the branches. It has been ascertained by Hopkinson that in some graptolites the hydrothecæ were separated from the cœnosarc by a well-marked septum, and that the cœnosarc was divided by septa into transverse joints. The oldest graptolite, according to Brogger and Hermann, is *Dictyograptus tenellus;* and the family Dichograptidæ, which includes complicated and elegant forms of graptolites, is older than the universal groups. This family appears in the Lower Silurian (Waring), becoming extinguished before the Upper Silurian is reached. The Phyllograptidæ and Lasiograptidæ seem to be confined to the lowest division of the Lower Silurian, the Leptograptidæ and Dicranograptidæ to the Lower Silurian, while the Diptograptidæ and Retiohtes commence in the lowest Lower Silurian, but are most developed at its upper boundary, and extend into the Upper Silurian. The simplest family, the Monograptidæ, are, according to Lapworth, strictly confined to the Upper Silurian. The genus Dictyograptus, of which Tullberg makes a new family (though Hermann ranges it with the Dichograptidæ), maintains itself through the entire Silurian, and passes into the Devonian.

Devonian.—Professor Williams has described (*Geol. Mag.*, Sept., 1885), *Prestwichia eriensis*, a new Limuloid from the Devonian of Le Bouf, Erie county, Pa.

Cretaceous.—The new facts regarding the fossil flora of the western Northwest Territory of the Dominion of Canada require the intercalations of three distinct plant horizons not previously recognized. One of these, the Kontame series, probably belongs to the Urgonian or Neocomian, or is at least not newer than the Shasta group. It seems to correspond to the oldest Cretaceous flora of Europe and Asia, and to that of the Korné formations in Greenland. The second or Mill creek series corresponds closely to the Dakota, and seems to represent the flora of the Cenomanian and Turonian divisions of Europe. The third sub-flora is that of the Belly river at the base of the Fort Pierre group. Though separated from the Laramie by the Pierre and Fox hill groups, it introduces the Laramie or Dominion flora, which continues to the top of the Cretaceous, and probably into the Eocene, and includes several species still surviving in America. Next comes the Laramie group itself, the fossils of which are found in Canada, chiefly in the lower and upper beds, the middle beds being poor in plants. Sir W. Dawson concludes that no cause for the mild temperature of the Cretaceous other than change of elevation need be invoked.

Tertiary.—According to Woodward, fifteen species of fossil sirenians have been referred to Halitherium, while two considerably larger species, both found in Italy, are placed in Felsinotherium, and closely resemble Halicore in dentition. *Prorastomus sirenoides* Owen, from Jamaica, differs widely from all other sirenians, but is nearer Manatus than Halicore. The dental formula is i $\frac{3-3}{3\ 3}$ c. $\frac{1-1}{1-1}$ p. m. $\frac{5-5}{5-5}$ m. $\frac{3\ 3}{3\ 3} = 48$. Felsinotherium has i $\frac{1\ 1}{0\ 0}$ m. $\frac{5-5}{5-5}$. An interesting discovery was a cast of the interior of the skull of *Eotherium ægyptiacum* at Mokattam, near Cairo, in 1875. The brain of the huge Rhytina is only one-sixth of the size of that of the manatee or dugong. The total number of extinct sirenians enumerated by Woodward, including Chirotherium from Piedmont; Chronozoōn from New South Wales; Crassitherium from Belgium; Dioplotherium and Hemicaulodon from South Carolina and New Jersey; Pachyacanthus from near Vienna; Rhytiodus and Trachytherium from France, and two extinct Manati, is twenty-eight. The recent species are three of Manatus and three of Halicore. Dr. Murie believes that the large number of fossil species described will probably have to be reduced into two or three genera.

MINERALOGY AND PETROGRAPHY.[1]

ETCHED FIGURES. — Under this general head are included etched figures proper (Aetz-Figuren of the Germans) and figures produced by weathering (Verwitterungs-Figuren). These were first studied, as early as 1816, by Daniell.[2] A little later, Leydolt[3] investigated the forms of the depressions on rough surfaces of crystals. Pape[4] next took up the subject. He drove off the water contained in many minerals and examined the shape of the figures resulting (Verstäubungs-Figuren). In later years, many other investigators have attempted to discover the relations between etched figures, those produced by weathering and the directions of cohesion in minerals. Baumhauer succeeded in proving that the shapes of etched figures were independent of the

[1] Edited by W. S. BAYLEY, Johns Hopkins University, Baltimore, Md.
[2] Quart. Jour. Sci., I, 1816, p. 24.
[3] Sitz.-Ber. der Akad., Wien, 1855, 15, p. 59.
[4] Poggendorf's Annalen, 124, p. 329, etc.

cleavage planes, but were intimately related to the symmetry of the crystal, and thus opened up a new method of investigating opaque minerals. In order to study more closely the connection between the figures produced by weathering and those produced by etching, Blasius,[1] of Strassburg, subjected a number of substances in crystal form to the action of alcohol, and also placed them in desiccators with strong sulphuric acid. As the result of a large number of experiments, he concludes that many of the figures produced by weathering (including etched figures) cannot be brought into close relation with the directions of cleavage or the curves of hardness in the substances acted upon. Moreover, their shapes differ according to conditions, and, finally, from a knowledge of the etched figures on a number of faces the shape of those on others can be deduced. F. Becke[2] adds further to our knowledge in an article on the etched figures of minerals of the magnetite group. Magnetite, spinel, franklinite and linnæite were treated with sulphuric, nitric and hydrochloric acids of different concentrations and during periods of different lengths, and besides with alkaline solutions. 1. On all the crystal faces, the figures were composed essentially of the same planes of etching, the principal planes of etching. 2. The principal planes of etching lie in a determinate zone. 3. These planes of etching offer the greatest opposition to the action of solvents. 4. Depressions are formed on such faces as belong to the zone of etching, elevations on those which lie far without it. 5. Cleavage planes cannot, at the same time, be planes of etching. 6. Linnæite, when etched with acids, deports itself like magnetite; when treated with alkaline solutions, an entirely different plane becomes the principal plane of etching. Consequently, it may be assumed that "the elemental atoms in the crystal molecule maintain a definite position with relation to one another." In linnæite (Co_3S_4), for instance, "the cobalt atoms are turned toward the cubic faces and the sulphur atoms toward the dodecahedral faces," because when treated with acid the cubic faces are dissolved fastest, but when treated with fused potash, the dodecahedral faces offer the least opposition to the solvent action of this reagent. Baumhauer[3] makes practical use of the method of etched figures in an investigation of the character of the massive bornite from Chloride, N. M. When a polished surface of this mineral is treated with nitric acid it breaks up into several fields, each of which reflects the light differently, showing that the massive material is made up of an irregular intergrowth of individual crystals. At the same time the fact is brought out that twinned inclusions of chalcocite and chalcopyrite are not uncommon.

[1] Zeits. für Kryst. und Miner., x, p. 221.
[2] Min. und Petrogr. Mitt., VII, p. 195.
[3] Zeitschrift für Krystallographie, x, p. 447.

ANDESITE.—The question of the best definition of andesite is again discussed by J. Siemiradzki[1] in an article on the rocks of Ecuador. Von Buch described it as a volcanic rock consisting of plagioclase and hornblende; and Lagorio as a volcanic rock composed of plagioclase, with the addition of augite, hornblende or mica. Rosenbusch[2] separates the mica and amphibole andesites from the augite andesite. Siemiradski finds that the same lava-stream varies in acidity, and that, though hornblende is more abundant in the more acid andesites, on the other hand augite and even olivine occur in very acid varieties, containing free silica, while hornblende is entirely lacking.[3] "No indication of the regular sequence of separation of augite, hornblende and mica with increasing acidity, as observed by Hague and Iddings,[4] can be detected." He suggests as the best definition of this class of rocks the following: Neutral or acid plagioclase rocks, with at least fifty-five per cent of SiO_2, with trachytic, basaltic or phonolitic habit, consisting of porphyritic andesine, with an iron-rich pyroxene, hornblende or mica in a groundmass, composed essentially of an acid andesine or oligoclase, and an acid glass (mixture of oligoclase substance and amorphous silica) containing microscopic pyroxene.

The porphyritic hornblende of these Ecuador andesites is surrounded by an opacitic rim and contains inclusions of the groundmass, which, under the microscope, are seen to consist of feldspar and augite microlites. Moreover, it is not confined to the most acid varieties. Consequently, the author suggests that it may have been produced, at great depths, in a magma saturated with superheated steam under great pressure, while the augite crystallized from a dry magma under comparatively little pressure—a theory very different from the one usually accepted.

WILDSCHÖNAU GABBRO.—In a communication on this subject, Cathrein[5] calls attention to the article of Hatch, already noticed in these notes.[6] He claims that the latter's hornblende-gabbro and amphibolite are chlorite-gabbro and chlorite-schist, and that there are no proofs of the close relation which that author supposes to exist between normal gabbro and serpentine on the one hand and amphibolite and epidote rock on the other.

PETROGRAPHICAL NEWS.—F. Becke[7] communicates a few notes on the rocks of the lower Austrian Waldviertel. At Marburg there occurs a granophyre in veins. It consists of zircon in small

[1] Geologische Reisenotizen aus Ecuador, N. J. B. Beil., Bd. IV, 1885, p. 195.
[2] Mikros. Phys. der Massigen Gesteine, 1877.
[3] Lagorio, Andesite des Kaukasus, p. 27.
[4] Notes of the volcanic rocks of the Great Basin. Amer. Jour. Sci., XXVII, 1884, No. 162.
[5] Miner. und Petrog. Mitth., VII, p. 189.
[6] NATURALIST, October, 1885, p. 992.
[7] Min. und Petrog. Mittheilungen, VII, p. 250.

yellow grains, chloritized biotite, dark-green hornblende, clear transparent orthoclase and microcline and opaque altered plagioclase in a groundmass of small brown plates of biotite and clear orthoclase and quartz in micropegmatitic growths. Pilite-kersantite from Spitz on the Donau and pyroxene-amphibolite from Aschauer are also described. In the same article Becke reports the result of a reinvestigation of Schrauf's kelyphite,[1] the alteration product of pyrope in olivine rocks. This substance, he thinks, is a mixture of a chrome-spinel and a silicate, probably hornblende. The reaction of the olivine on the garnet he represents thus:

$$\underset{\text{pyrope,}}{Mg_3Al_2Si_3O_{12}} + \underset{\text{olivine,}}{Mg_2SiO_4} = \underset{\text{spinel,}}{Al_2MgO_4} + \underset{\text{amphibole.}}{Mg_4Si_4O_{12}}$$

——In a letter to the Neues Jahrbuch,[2] F. H. Hatch describes hypersthene andesite from Mt. Chachani, in Peru.——Inclusions of mica-schist, marble and syenite are mentioned[3] by Hussak as occurring in the phonolite of Oberschaffhausen.——The same writer[4] denies the widespread existence of cordierite in Hungarian andesites, but finds it in many trachytes.——Kolenko[5] mentions hornblende pseudomorphs after olivine as characteristic of a metamorphosed olivine diabase from the north shore of Lake Onega, in the Caucasus. The olivine substance is entirely changed into aggregates and crystals of a non-pleochroic hornblende.——Cathrein[6] communicates an interesting paper on the alteration of garnet in the amphibolites of the Tyrolese Central Alps. Pseudomorphs of epidote, scapolite, oligoclase, hornblende, saussurite and chlorite are described in detail. The scapolite substance is intimately mixed with epidote and plagioclase, and the whole is surrounded by a rim of hornblende crystals. In the change to hornblende, crystals of magnetite separate and the excess of silica, magnesia and lime unite to form epidote.

MISCELLANEOUS.—In a discussion concerning the conduct of the zeolites with reference to their water constituent, C. Bodewig[8] shows that the loss of weight which phacolite suffers over $CaCl_2$ must be due to loss of water of crystallization and not to loss of hygroscopic water. He also contests the idea of Jannasch[9] that every desiccating agent abstracts a certain definite amount of water from these minerals and consequently *some* of the loss over $CaCl_2$ may be due to loss of water of combination.——The twelfth edition

[1] Ueber Kelyphite. Neues Jahrb. f. Miner., etc., 1884, II, p. 21.
[2] Band II, p. 73, 1885.
[3] Neues Jahrb. f. Mineralogie, 1885, II, p. 78.
[4] Ib., p. 81.
[5] Ib., p. 90.
[6] Zeitschrift f. Krystallographie, X, p. 433.
[7] Miner. und Petrog. Mittheilungen, VII, p. 250.
[8] Zeitschrift für Krystallographie, X, p. 276.
[9] Ib., VIII, p. 429.

of Naumann's "Elemente der Mineralogie"[1] has just appeared. The work has been newly revised and brought up to date by Dr. Ferdinand Zirkel, who has undertaken this duty since the death of Naumann in 1873. The new edition contains about fifty pages and thirty-three wood-cuts, more than the eleventh (1881). The chemical formulæ used have all been recalculated and the recent advances in the field of optical and physical mineralogy have been incorporated in the body of the work, so that the new book is the most complete and satisfactory treatise on general mineralogy published in any language.——An abstract from the forthcoming "Mineral Resources of the United States, Calendar Years 1883 and 1884," has just been received. It is entitled "Precious Stones."[2] The author is G. F. Kuntz. The paper treats of the production of precious stones in the United States in 1883 and 1884 and their importation. The total value of precious stones found during 1884 was $82,975, including $800 worth of diamonds. The gold quartz sold as specimens during this year is valued at $40,000, and that cut for gems or ornamental uses at $100,000. The value of the importations is estimated at $9,253,376. The most important finds during the year were as follows: At Auburn, Me., colorless, pink, blue and golden tourmalines to the value of $1500, and at Mt. Mica, in the same State, tourmalines, beryls and aquamarines to the amount of $4145. At Florissant, Cal., about $1000 worth of topaz was taken out. The reports in the newspapers of remarkable finds have all been investigated and have proven to be unreliable. The great "Georgia Marvel" or "Blue Ridge Sapphire," for instance, which was supposed to be a sapphire worth $50,000, turned out to be nothing but a "piece of rolled blue bottle-glass." The paper is interesting as showing just how far we can rely upon our own resources to supply us with ornamental stones. The author also mentions several uses to which domestic material can be applied with fine effect.

BOTANY.[3]

CAN VARIETIES OF APPLES BE DISTINGUISHED BY THEIR FLOWERS.—To a botanist this may seem like a queer question, capable only of an answer in the affirmative, but pomologists have quite universally held to the opposite view. Quotations, like the following, could be made from our most eminent writers of pomological books:

"Peaches are partially classified by the size and color of the petals, but in all the other fruits, as in apples, pears, plums, cherries, etc., the flowers vary but slightly in form and color."

Another says: "Little difference exists in the flowers."

[1] Elemente der Mineralogie. 951 ills., 782 pp., Leipzig, Wilhelm Engelmann.
[2] Washington, Government Printing Office, 1885.
[3] Edited by Professor CHARLES E. BESSEY, Lincoln, Nebraska.

At a meeting of the Michigan State Pomological (now Horticultural) Society, held in 1873, the writer presented a paper on this subject in which he accurately described quite a number of kinds of apples by the flowers.

To the pomologist the term "flower" means the showy petals; to the botanist it means calyx, corolla, stamens and pistils. These floral characters are as constant and reliable for distinguishing varieties as are those characters of the fruit which are usually employed.

In apples the points of the calyx vary in breadth, size and in other particulars. The petals vary in size and shape in different varieties, and some in color. Not very much was made of the stamens, but the styles and stipe furnish excellent characters.

Dr. Hogg, of England, pointed out the value of the shape of the calyx-tube and the position of the stamens on the inside of the tube, but in our American apples, at any rate, these points are not so reliable as are those pertaining to the stipe and styles.

In 1879, at the Rochester meeting of the American Pomological Society, I presented an illustrated paper on the classification of apples, in which the peculiarities of the flowers formed an important part. Many flowers were examined from different trees in various localities. Over a hundred varieties have been examined.

I have since that time frequently called the attention of my students to this subject, and last spring (in 1885) suggested it to one of our graduates, Mr. W. L. Snyder. I have had some of his drawings carefully copied for your use.

Unfortunately in these cases the petals were not drawn, but a glance at the lobes of the calyx, and especially a close examination and comparison of the stipes and styles will show a great difference in the length, breadth, hairiness and other points of the styles.

At the Boston meeting of the American Pomological Society, in 1881, I showed that a similar difference exists in the lobes of the calyx, the shape and size of the petals of pears, but in these flowers the stipe is very short or wanting. The styles vary as do those of apples.

Mr. Snyder also made some notes and drawings of the flowers and inflorescence of some of our cultivated varieties of strawberries. These are quite as marked as those here shown for the flowers of apples.

In case of apples probably 3000 or more varieties have been described by the fruit alone. It is needless to say that with a variety of soils and climates it is next to impossible to define so many in a manner which shall be at all satisfactory.

A similar difficulty exists in our sorts of pears, peaches, plums, grapes, strawberries, raspberries and a myriad of cultivated grains and vegetables; exactly how many I do not know.

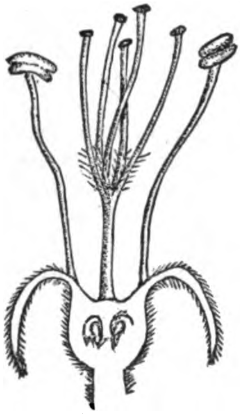


Fig. 1.

Fig. 2.

Fig. 3.

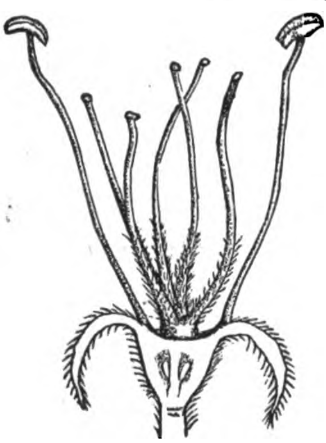


Fig. 4.

Fig. 5.

FIG. 1.—Variety "Red Canada." FIG. 2.—"Talman Sweet." FIG. 3.—"Sweet Bough." FIG. 4.—"Rambo." Fig. 5.—"Wagner." All × 3.

A friend has just sent me 160 named lots of cultivated beans. How are they usually described? Mainly by the time of fruiting, size and color of pod and the peculiarities of the seeds.

We are living in a time when there is much said about the difficulty of describing so many varieties of cultivated plants. It seems to me the correct solution of this problem is here suggested. Instead of describing lettuce and turnips and onions by the shape of leaf and head, color and shape of root, or the color and shape of bulb respectively, let the inflorescence and flowers be carefully examined and a clear record made of *all* the characters which prove to be most reliable. The time has come for more careful work in this direction. The skill of a good botanist should be joined to that of a good horticulturist.—*W. J. Beal, Agricultural College, Mich.*

Formation of Starch in the Leaves of the Vine.—Sig. Cuboni has made a series of observations (Rivista di Viticoltura ed Enologia Italiana, 1885) on the formation of starch in leaves of the vine. In March and April, when the leaves are first formed, starch was never found, even in bright sunshine. It first made its appearance in May, and the quantity increased continually till July. This is not solely dependent on difference in temperature, since starch is still formed in the leaves at the end of October and November; while even in the height of summer the young leaves and shoots are not able to form starch until they are at least a month old. It depends, however, to a certain extent on the maturity of the chlorophyll-grains.

In a leaf containing no starch at the outset, abundance was found after an hour's exposure to the direct action of the sunlight; and the maximum quantity was obtained by two hours' intense sunshine. Four hours of complete darkness is sufficient to cause the whole of the starch to become absorbed.

Although the youngest leaves are unable to form starch, the maximum development is not obtained by the lowest leaves on a branch, but by those on the middlemost nodes; on a branch containing sixteen leaves, by those from the seventh to the eleventh, the lowest showing less than half the maximum power of production.

If an annular incision is made above and below a leaf, separating the elements of the soft bast, the starch in the leaf is not absorbed and transformed in the dark; but if a similar incision is made only below, or only above the leaf, the ordinary process is not disturbed; and this is also the case if a leaf separated by an incision on both sides has a panicle of fruit or flowers opposite it on the same node. No starch is formed if the leaves are etiolated, or attacked by *Peronospora viticola.*—*Jour. Royal Mic. Society.*

The Production of Male and Female Plants. — Recent observations and experiments by Hoffman (Bot. Zeit., 1885) confirm the view hitherto held by some biologists that the production of the male organism is due to insufficient nutrition. In *Lychnis diurna* and *vespertina*, *Valeriana dioica*, *Mercurialis annua*, *Rumex acetosella*, *Spinacia oleracea* and *Cannabis sativa* dense sowing increased the amount of male plants.

Pear Blight Bacteria and the Horticulturists.—Although to the mind trained in the logic of investigation there can be no doubt as to the cause of pear blight, there are yet some horticulturists who do not feel convinced. With them the facts—plain facts—brought out by Mr. Arthur at Ann Arbor, and reproduced in popular form in the December Naturalist, are spoken of as the "Bacterian theory of pear blight," when as a matter of fact there was no "theory" in the presentation. As was remarked by one of the auditors at Ann Arbor, Mr. Arthur's paper amounted to a demonstration, and as a demonstration it must be accepted. One may as well attempt to controvert a demonstration in geometry as to attempt it in this case.

We have observed two principal varieties of denials, and both illustrate the fact that the mind untrained in the methods of scientific reasoning is most incredulous of demonstrations, and most credulous of unproved assertions. (1) It is held on the one hand that the bacteria observed are an *accompaniment* and not the *cause* of the disease, and this in face of the fact that all of Mr. Arthur's investigations were directed to this very point, Professor Burrill having long ago shown the presence of bacteria beyond a doubt. Our horticultural friends must bear in mind that Mr. Arthur's work was not to find whether bacteria *are present* in pear blight. Of that almost any one who has access to a microscope can satisfy himself with but little labor. He undertook the solution of the very matter which is now brought up so calmly, innocently and confidently. And he made no announcement until the demonstration was reached. Let our friends read the testimony candidly and they will be fully satisfied upon this point.

(2) It is held by another class of disbelievers that what Professor Burrill and Mr. Arthur have been working upon is a kind of blight which is quite distinct from the real Simon-Pure blight which works such havoc in the orchards. That is, we have here an attempt to diagnose off-hand, out of sight and hundreds of miles away, the disease to which two trained men gave years of close personal study.

But science is patient, and no doubt the next work of Mr. Arthur will be the study of cases of this so-called other kind of blight. It will then be interesting to know what new line of defense will be set up by those who "do not believe in the bacterian theory of blight."

Botanical News. — Late numbers of the *Botanische Zeitung* contain articles as follows: The pith rays of the Coniferæ, by A.

Kleeberg; The formation and transportation of carbohydrates in foliage leaves, by A. F. W. Schimper; Journal of the fifty-eighth meeting of German naturalists and physicians in Strassburg.——In *Flora* the more important recent articles are lichenological contributions, by Dr. J. Müller; Contributions to our knowledge of the development and the anatomical structure of the fruit-leaves (carpophylls) of Cupressineæ and the placentæ of Abietineæ, by Arno Kramer; and the continuation of H. G. Reichenbach's Comoren Orchids. In Kramer's paper, just referred to, the conclusion is reached that the female cone of the Abietineæ is a single flower and not an inflorescence. The scale is regarded as a placenta, and begins its development as an axillary outgrowth from the axils of a fruit-leaf.——In the *Deutsche botanische Monatsschrift* Paul Richter and Dr. F. Hauck, the well-known German algologist, announce the early appearance of the first fascicles of a distribution of algæ under the title of "Phycotheca Universalis." Each fascicle is to contain fifty numbers, and will be sold for sixteen to eighteen marks ($3.81 to $4.29). Intending subscribers may correspond with Ed. Kummer, the well-known Leipzig bookseller.——In the July-August number of *Hedwigia* Professor Oudemans describes a new species of Puccinia occurring on *Veronica anagallis* in Holland, and to which he gives the name of *Puccinia veronicæ-anagallidis.* It is to be looked for in this country.——The September-October number of the same journal contains a Contribution to the mycologic flora of Missouri, by Dr. G. Winter and C. H. Demetrio. In all 350 species are enumerated, many of which are described as new. Among the latter the most interesting are *Æcidium cerastii* on *Cerastium nutans*, *Diatrype roseola* on dry branches of *Quercus tinctoria*, *Didymosphæria phyllogena* on fallen leaves of *Liriodendron tulipifera*, *Sphærella desmodii* on languishing leaves of *Desmodium canescens*, besides many "Fungi Imperfecti" of the genera Cercospora, Phyllosticta, Septoria, etc.——M. C. Cooke contributes to the December *Grevillea* papers on New British Fungi, Fungi of the Malayan peninsula, *Valsa vitis* again, Synopsis Pyrenomycetum, and British Sphæropsideæ.——The most important paper in the *Journal of Botany* for November is F. N. Williams' Enumeration of the species and varieties of the genus Dianthus. In all 235 species are catalogued, of which nine are described as new to science.——L. H. Bailey's Notes on Carex, in November *Botanical Gazette*, are interesting and helpful.——The December *Journal of Mycology* is devoted to A synopsis of the N. A. species of Dimerosporium and Meliola, by Dr. Geo. Martin; New fungi, by J. B. Ellis and B. M. Everhart; and Index. It is the intention of the managers of this journal to increase its popular interest by a series of sketches of the lives and works of the more noted mycologists. The journal has, as it appears to us, earned a place in botanical literature, and we hope to see it increase its usefulness.

ENTOMOLOGY.

THE PREPARATORY STAGES OF CALOCAMPA CINERITIA (Grote).—One hundred or more eggs were found at Warwick, R. I., clustered together upon a twig of white birch, May 10th, 1885. Diameter of egg 1^{mm}. Shaped like a depressed cone, ribbed vertically and dark gray in color. They hatched in the same day that they were found.

Larva upon emergence.—Length 3^{mm}; color, light bluish-green, sprinkled with black. Two pairs of pro-legs only. Head ochreous yellow, large and prominent; two transverse rows of blade tubercles in each segment, each giving rise to a single, simple black hair or bristles. Head likewise provided with black warts and bristles.

After first molt.—Passed the first molt after six days, after which the length of the body was 7^{mm}; uniformly cylindrical and slender. Two front pairs of pro-legs rudimentary. Head less prominent, and green, concolorous with the rest of the body, which is slightly darker than before. Black tubercles disappeared. A single transverse row of minute black bristles in each segment, hardly visible except by the aid of the microscope. These longitudinal dorsal and two lateral lines of very light green. Ventral half of the body of a lighter shade than the dorsal.

After second molt.—Five days later, they began to pass the second molt, after which they measured when extended upon a leaf 12^{mm} in length. Markings same as after the first molt, but more pronounced, dorsal portion of a darker green, and the stripes creamy-white.

After third molt.—After ten days, they passed the third molt. Length 29^{mm}; color, uniform yellowish-green. A pronounced white stripe running the whole length of the body on each side, and above this a much narrower subdorsal stripe on each side of the single dorsal line. Five stripes in all. Dorsal portion of the body sprinkled with white specks. All the pro-legs fully developed.

After fourth molt.—Ten days later, it passed the fourth molt. Length 30^{mm}. Body straight and cylindrical. Head and first segment large and prominent, thicker than the rest of the body. Head rather flat. Color of body below reddish ochreous, head of a lighter shade. A narrow longitudinal white stripe running the entire length of the body, between these stripes a rich yellowish-brown. A dark brown velvety stripe running down the center of the back, with a V-shaped mark of the same color on each segment, with the opening towards the head.

After ten days more without any indication of passing another molt, the larvæ underwent a very decided change. They lost entirely their velvety look, and assumed the greasy appearance of cut-worms, curling themselves up when disturbed, seeking retirement when not feeding, and in all ways taking up the habits of this group of noctuid larvæ.

Being transferred to a cage provided with earth, they at once buried themselves, but came out at night to feed. They continued this life for perhaps a fortnight, when they gradually left off feeding. Just when pupation occurred it was impossible to tell, as the larvæ remained in the ground some time in a torpid state before this change took place, and at this time many of them died.

The pupæ, which had been reserved for description, were unfortunately destroyed by mice. They were of a dark shining brown color, rather thick and blunt at the anal extremity, and somewhat flattened at the thorax. The molts emerged from the 20th to the 30th of September, some two months or more after pupation probably took place.—*Howard L. Clark, Providence, R. I.*

MORPHOLOGY OF LEPIDOPTERA.—In the *Zeitschrift für Wissen. Zoologie* for Oct. 27, N. Cholodkovsky states that it has been found that three species of the Linnæan genus Tinea possess only two Malpighian vessels, a most unexpected phenomenon, and until the present time an isolated fact in insect anatomy, unless we except certain Coccidæ, which have been found by Leydig and Mark to also possess but two Malpighian tubes. On the other hand, Cholodkovsky has found in *Galleria mellonella* Linn. a very peculiar form of Malpighian vessel, which up to now has been described in no other insects, and which only finds its parallel among the Arachnida. This example is an illustration, he says, of the utter incompleteness of our present knowledge of insect anatomy.

In several female *Nematois metallicus* Pod. Cholodskovsky found that each ovary consisted of not less than twelve, and in one case twenty egg-tubes. The number of egg-tubes in Lepidoptera generally is four. There is only a single known exception to this rule. Dr. Alexander Brandt in 1876 discovered that *Psyche helix* possessed on each side six egg-tubes, while Professor Ed. Brandt stated verbally that *Sesia scoliiformis* possesses fourteen egg-tubes.

Cholodkovsky then describes the external and internal genitalia of Nematois, and, in describing the ovipositor, refers to the much more highly organized ovipositor of the common house-moth (*Tineola biselliella*).

All Lepidoptera possess two compound testes, which in the greater number are united by a complicated set of coverings into an unpaired organ. Since each testis consists of four seminal follicles they are in every respect homologous with the egg-tubes of the females There is anatomically a complete and clear homology between the female and male sexual glands of the Lepidoptera. This fact is not without significance in the morphology of Lepidoptera, especially since it becomes a link connecting the Phryganidæ with the Lepidoptera, though only from forms allied to the Phryganidæ is the phylogenetic derivation of the Lepidoptera conceivable.

He also finds a small chitinous ring at the end of the abdomen of the male, which he regards as the rudiment of a tenth abdominal segment.

Cholodkovsky regards these cases of the occurrence of primitive characters in Lepidoptera as instances of a periodical atavism, or retrogression to the most primitive form of anatomical structure. In conclusion, the author with good reason finds fault with the term "Microlepidoptera," thinking it artificial and absurd to classify animals by their size alone.

Flights of Locusts at San Luis Potosi, Mexico, 1885.—We have received the following description of a flight of locusts at San Luis Potosi, Mexico, in a letter dated June 9, 1885, from Dr. G. Barrœta, well known as one of the most cultivated scientists in Mexico:

"On the 31st May a cloud of grasshoppers came from the N. E. and S. E. to this city, and remained about three hours, leaving only on account of rockets, the ringing of bells and every kind of noise. Never before in this century have locusts invaded this land. By this mail I send a tin box with samples. Those in white paper reached a year ago certain places of the state, 150 miles east of this city, and at the altitude of 3000 feet above the sea. They were collected in Rioverde, aud then the cloud took its way to the southeast. In the aforesaid box, those in blue paper belong to the invading swarm which visited the city on May 31st. I found no difference between them, and suppose them to be the progeny of the swarms noticed in 1884, or, at least, the same species."

Unfortunately the specimens were never received, so that we are unable to give the name of the species.—*A. S. Packard.*

Longevity of Ants.—Not the least interesting fact which has resulted from my observations has been the unexpected longevity of these interesting insects. The general opinion used to be that they lived for a single season, like wasps. Aristotle long ago stated that queen-bees live for six and some even seven years. Bevan, however, observes that "the notions of both ancients and moderns upon the subject have been purely conjectural. Indeed, it appears to be somewhat doubtful whether the length of life which the former seem to have attributed to individual bees was not meant to apply to the existence of each bee-community."

The nests, however, which I have devised have enabled me to throw considerable light on this question. The queen ants are so easily distinguished from the workers that they can be at once identified, while, if a nest be taken in which there is no queen, we can satisfy ourselves as to the workers; because, though it is true that workers do sometimes lay eggs, those eggs invariably produce male ants. Hence, in such a case, the duration of the nest gives us the age of the workers; at least they cannot be younger, though, of course, they may be older. In this way I have kept workers of *Lasius niger* and *Formica fusca* for more than seven years. But, what is more remarkable still, I have now two queens of the latter species which I have kept ever since 1874, and which, as they were then full-grown, must be now nearly twelve years old. They laid fertile eggs again this year, a fact the interest of which physiologists will recognize. Although a little stiff in the joints, and less active than they once were, they are still strong and well, and I hope I may still keep them in health for some time to come.—*Sir John Lubbock in Contemporary Review for Nov.*

ENTOMOLOGICAL NEWS.—In the Proceedings of the Entomological Society of Belgium, Dec. 5., the venerable Senator M. de Selys-Longchamps gives the outlines of a revision of the Agrionines.——The *Zeitschrift für Wissen. Zoölogie*, October 27, contains an elaborate article on the anatomy of the Mallophaga, by F. Grosse; it gives excellent figures of the mouth parts.——Mr. L. Bruner publishes in the Bulletin of the Washburn College laboratory of natural history a "first contribution to a knowledge of the Orthoptera of Kansas," with descriptions of a number of new species.——In the same publication, Mr. F. W. Cragin notices certain Myriopods and Arachnids of Kansas.——In the Memoirs of the National Academy of Sciences, Mr. S. H. Scudder describes and figures a Tertiary Orthopod; it has no distinct head. It is referred to the Thysanurans, and regarded as the type of a suborder called Ballostoma. We would add, that the thysanurous characters do not seem to be well marked, while it is possible that the specimens, though numerous, had lost their heads.——In Dr. Agassiz' report as curator of the Museum of Comparative Zoölogy, it is stated that the museum has received from the Peabody Academy of Science at Salem the most important collection of insects ever added to the museum. It contains a large number of types described by prominent American and European entomologists. The collection, we may add, was brought together mainly by Professor A. S. Packard. It contains a large proportion of Packard's types, including those of his monograph of geometrid moths, of which only four species are wanting, and nine described by him from specimens belonging to other entomologists. It also comprises types of Mr. Grote and the late V. T. Chambers, as well as types of Zeller, Staudinger, Foerster, Walker, etc.

ZOÖLOGY.

Antidote to the Scorpion's Sting.—Already an antidote has been discovered to the sting of scorpions, which, although rarely fatal, is extremely painful, while the poison is closely allied to that of the venomous snakes. Mr. A. M. Markham, of the Indian Civil Service, has written to one of the Indian papers calling attention to the fact that the root of *Achyranthes aspera*, known popularly as *chirchirra*, affords almost instantaneous relief from the pain caused by the sting of a scorpion. The plant is very common everywhere in India, and is one of those whose clinging burrs are such a nuisance on one's legs when out shooting. The root, macerated in water, is applied to the part stung, and a small quantity is drunk in water. If this be done quickly, there is absolutely no pain half an hour or so after the sting, instead of the twelve to twenty-four hours of intense suffering which follow an untreated sting.—*London Standard.*

The Crustacea of the Black Sea.—Mr. Waldemar Czerniawsky, already known for his works on the fauna of the Black sea, has now published at Charkoff, a work on the "Crustacea decapoda Pontica littoralia," accompanied by several plates, being a very elaborate description of the Black Sea Decapods. The number of Pontic species of Decapods has been increased by twenty, reaching thus forty-eight species, with numerous varieties, though it will probably be greater when the depths of the Black sea have been better explored. The results of this work are numerous and interesting. The species offer altogether a very great variety of forms. The Black sea contains the local forms of Mediterranean varieties, while in the Celtic region are found the local forms of other varieties. The author asserts that the metamorphosis of the superior crabs, such as Carcinus, which presents nine different stages, are a repetition of their genealogy, and arrives at a series of very interesting conclusions as to the genealogy of different species. All three species of Astacus which are found in the Ponto-Caspian fauna are maritime forms which have immigrated into sweet water, and even the *Astacus pachypus* Rathke, of the mountain-like Abran, is a remainder of a maritime fauna; so also Thelphuca, which has gigantic representatives in the South Caspian. Certain crabs reach really gigantic size in the Ponto-Caspian region, such as *Eriphia spinifrons* and *Carcinus mœnas* on the shores of Crimea and at Odessa. While most crabs reach a great development only in very salt and warm water, others reach the same size under the influence of reverse conditions. The Decapods of the Azof sea have not yet been explored. The descriptions of the species and their varieties being given in Latin, as also the explanations to the plates, the work is rendered accessible to all zoölogists, many of whom however, will regret not to be able to understand the notes (mostly zoö-topographical and sometimes adding minor details to the description), which are in Russian.—*Nature, March 5, 1885.*

THE MOLTING OF THE LOBSTER.—During the past season I have been able to make some observations on the mode of molting of the lobster. In Casco bay, Maine, the lobster molted during the second and third week of July. According to the lobster-fishermen, the creature molts but once a year, and as confirmatory of this the lobsters we saw were in several cases covered with patches of polyzoans, with large barnacles, mussels, etc., which could not have been of the present year's growth.

Shortly before the animal molts the parts between the segments are much swollen, and have a livid color. Meanwhile the inner side of the flattened basal joints (3–5) of the large claws become soft, the lime on the crust partly disappearing, leaving an irregular oval solid portion; in this way the contents of the large hand or claw can be drawn through the basal portion of the limb. The first step in the ecdysis is the splitting or partial separation of the two halves of the carapace; it may entirely separate posteriorly, or the two halves remain together, and the animal withdraws its body out of the sutures between the thorax and first abdominal segment. The integument of the legs is molted last, and when owing to rough handling, the process is delayed, the extremities of the legs slough off. The entire integument, with all the appendages of the head, thorax, and the abdomen are molted as a whole, but the abdominal legs are molted before the thoracic ones. I have found all the parts of the crust connected, and floating in the "lobster car," even including the lining of the proventricle or stomach, and the apodemes of the head and thorax. After the molt the soft and flabby lobster lies nearly motionless, occasionally, if disturbed, giving a flap with its "tail." It remains inactive for nearly or quite a week, until the new crust becomes hard.

I am convinced from my observations that the deformities in the big claws as well as other parts occur at the time of molting; as after disturbing the symmetry of the claws in our specimen, the deformity persisted.—*A. S. Packard.*

THE OLDEST TARSUS (Archegosaurus).—The Neues Jahrbuch für Mineralogie, Jahrgang 1861, pp. 294–300, contains a paper by Professor Quenstedt, of Tübingen: "Bemerkungen zum Archegosaurus." On Plate III, connected with that article, a nearly entire hind-foot of Archegosaurus is figured (fig. 6). The tarsals of this foot are preserved in their original position, and it is of very high interest; but, strange to say, this figure of Archegosaurus has been entirely overlooked, and is never mentioned in any paper relating to the tarsus of vertebrates.

Professor Quenstedt believes that there are ten or twelve tarsal bones preserved. The question now is, What are the homologies of these bones?

On the whole, the hind-foot recalls very much that of Cryptobranchus and Menopoma. One or perhaps two bones are connected with the tibia; if there is only one, this must be the tibiale. Two elements are attached to the fibula—the intermedium and the fibulare. Four metatarsals are preserved, but it is possible that there were five. Each of the four metatarsals is supported by one tarsal bone. Between the four bones of the distal series and those of the proximal one there are to be seen *four* additional bones. The inner one I consider the tarsale$_1$, belonging to the first digit not preserved. The remaining three bones must be considered as three central bones.

If two bones are connected with the tibia, the outer one represents the tibiale, the other one a centrale, reaching the tibia in the same way as in Salamandrella (Wiedersheim). In this case, we have four central bones. Between the fibulare and tarsale$_5$ there is a large space without any bones. There is little doubt, I think, that there existed a sixth tarsal bone in the distal series, as in Cryptobranchus, remaining cartilaginous, and therefore not preserved.

Wiedersheim[1] described three central bones in the tarsus of the Axolotl; fig. 8, pl. xxx, comes nearest to the condition in Archegosaurus.

There are two explanations of the morphology of the tarsus in Archegosaurus, if there are five digits:

1. Tibiale, intermedium, fibulare; centrale$_1$, centrale$_2$, centrale$_3$; tars.$_1$, tars.$_2$, tars.$_3$, tars.$_4$, tars.$_5$, tars.$_6$.

2. Tibiale, intermedium, fibulare; centrale$_1$, centrale$_2$, centrale$_3$, centrale$_4$; tars.$_1$, tars.$_2$, tars.$_3$, tars.$_4$, tars.$_5$, tars.$_6$.

Archegosaurus belongs to the Rhachitomi, the oldest batrachians known. *The presence of certainly three, perhaps four central bones, is a new proof for the correctness of the position given to this group by Professor Cope.—Dr. G. Baur, Yale College Mus., New Haven, Conn., Dec. 17, 1885.*

THE INTERCENTRUM OF LIVING REPTILIA.—The Pelycosauria of the Permian formations possess intercentra in the dorsal, lumbar and sacral regions. In no living reptile have intercentra been described, so far as I know, in that part of the column, excepting in Sphenodon (Hatteria).[2] I find them also in *Gecko verticillatus* Laur. (*G. verus* Gray). In these forms intercentra are developed between *all* vertebræ.

It is probable that the same elements will be found in the other Geckonidæ and in the amphicœlian Uroplates, the only genus of the family Uroplatidæ.

Lumbar intercentra in the Mammalia are first mentioned by Owen[3] in the mole. Meyer[4] finds these elements also in the pos-

[1] Wiedersheim R. Ueber die Vermehrung des Os centrale im Carpus und Tarsus des Axolotls. Morph. Jahrb., Bd. VI, 1880, pp. 581–583, pl. xxx.

[2] See Albrecht, Bull. Mus. Roy. Hist. Nat. Belgium, 1883, p. 190.

[3] Owen, R. On the cervical and lumbar vertebræ of the mole (*Talpa europæa* L.). Brit. Assoc. Rep., 1861, pp. 152–154. London, 1862.

[4] Meyer, O. Insectivoren und Galeopithecus geologisch alte Formen. Neues Jahrb. für Min., 1885, Bd. II, pp. 229–230.

terior dorsals and the sacrals, and I can confirm his observations. —*Dr. G. Baur, Yale College Mus., New Haven, Conn., Dec. 19, 1885.*

The Intercentrum in Sphenodon.[1]—Researches into the embryology of the Urodela and Anura have not yet brought to light any traces of the rhachitomous structure; a condition of things which is probably due to cœnogeny or falsification of the embryonic record—a phenomenon which is not uncommon. There can be no doubt, however, that the entire record was presented in the embryonic history of Permian land Vertebrata, and for a long period subsequently, but that the rhachitomous stage has been, *with the true centrum*, lost from the batrachian line at least. The only existing reptile which could be expected to show important traces of the ancestral, or embolomerous stage, is Sphenodon. This genus, as is well known, is the living representative of the order Rhynchocephalia, the nearest order to the Theromorpha. Having fortunately a specimen in alcohol, presented to me by Dr. Hector, the able director of the Geological Survey of New Zealand, I examined the caudal vertebræ to determine the connections of the chevron bones. I find these to be attached, not principally to the centra, but to a cartilaginous disciform intercentrum, closely resembling that of Cricotus.[2] The intercentrum has so much the form, including the rounded superior surface and the foramen chordæ dorsalis, of that of the Permian genus of Batrachia, as to impress on me still more strongly the probability of the Embolomeri being the batrachian type which is ancestral to the Reptilia. An illustrated memoir on this subject is at present in press.

The centra differ much from those of Cricotus in their form, resembling in outline those of the Pelycosauria. They however have the vertical median partial suture seen also in the Lacertilia, as already described by Günther. The caudal vertebræ are so gradually modified as we followed them forwards, however, as to make it probable that these halves do not represent any of the elements of the rhachitomous column besides the true centrum.

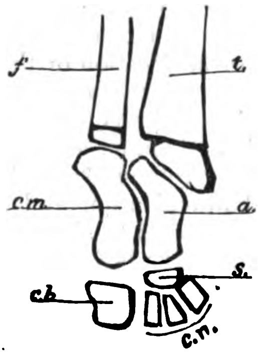
I add that there is probably a hypocentrum pleurale in the cervical region of the rhachitomous Eryops. They become ossified early with the posterior side of the intercentrum in front of them.—*E. D. Cope.*

On the Tarsus of Bats.—In the course of some recent observations made upon the tarsus of bats, I ascertained that the astragalus and calcaneum were elongate, and exhibited the general characters of these bones in mammals in which little or no weight

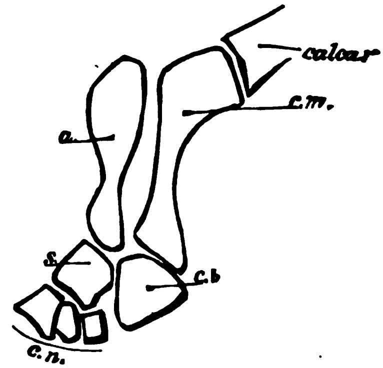
[1] On the Batrachian Intercentrum, Naturalist, 1866, p. 76.

[2] Since the above was written, Vol. II, pt. II, of Fritsch's Fauna der Gaskohle has come to hand. It contains a note on the intercentra of Sphenodon.

is borne upon the posterior extremities. Both bones were so disposed that the larger end of each is directed proximally. The general form was that of a metatarsal element, with the exception of the body or shaft, which was notably narrowed. In



Rhinolophus capensis (young).

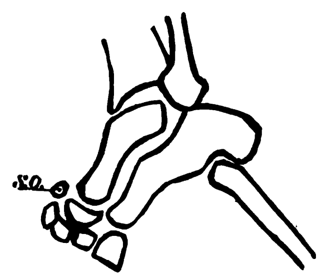


Carollia.

Chilonycteris.

Rhynchonycteris.

Vespertilio subulatus.



Atalapha novæboracensis.

f, fibula; *t*, tibia; *cm*, calcaneum; *a*, astragalus; *s*, scaphoid; *cb*, cuboid; *cn*, cuneiforms; *so*, supernumerary ossicle.

Rhinolophus the calcaneum entered into the ankle joint. In the other forms examined the calcaneum was independent of the joint. In the Phyllostomidæ (as well as in Natalus and Rhynchonycteris) the calcar of the calcaneum was placed in axial line with that of the bone last named. In other families the calcar was adjoined to the calcaneum at the outer side and near the proximal end. The astragalus and calcaneum were nearly of the same size in most forms, the calcaneum being the larger. In the aberrant form Rhynchonycteris the astragalus was nearly twice the length of the calcaneum. I have appended a few diagrammatic sketches of the tarsus.

The method employed in studying the tarsus consisted in removing all the soft parts of the foot, immersing in absolute alcohol, transferring to oil of cloves and mounting on a glass slide. A low power of the microscope resolves all the essential structures. —*Harrison Allen.*

Range of the American Bison.—Late issues of the St. Paul *Pioneer Press* report: "Reliable cowboys just arrived in Miles City, Mont., report that at the Lower Musselshell round-up they saw a fresh trail of about 100 buffalo on the head of the Big Porcupine last week, and had seen twelve head a few days before. They killed one out of the twelve. The number of wild animals on the North Yellowstone ranges have proved not only a source of annoyance to herd owners, but also of great damage to these newly stocked ranges. Round-up parties, in scouring those districts this spring, complain of the great number of calves killed and crippled by wolves and other wild animals. On Custer creek calves were found that suffered from torn and bitten backs, which the boys attributed to the attacks of wildcats. Had the calves been hamstrung the work would have been charged to wolves instead of wildcats. The loss from the above source is probably greater than most people would imagine." "The Maginnis boys met on their last trip probably the last remnant of the mighty herds of bison that once roamed over these plains. About 200 wanderers were encountered in Flatwillow Creek bottoms, and for a time the round-up lived on succulent, juicy buffalo humps instead of choice Montana beef."—*Forest and Stream.*

Zoological News.—*Invertebrata.*—Professor H. Carpenter, reviewing the arguments of the French naturalists against, and of the German in favor of, the separateness of the blood-system and water vacuum system in echinoderms, states his belief in their separateness. Ludwig's observations have as yet not been disproved, as no one has ascertained that the blood-vascular system communicates with the exterior through the madreporite.——Five new Bulimini from the Levant have been described by Dr. O. Bœttger (P. Z. S., 1835, 23).——The ninth part of the description by the late T. G. Jeffreys, of the Mollusca of the *Lightning* and *Porcupine* expeditions contains the Yanthinidæ, Naticidæ, Neritidæ, Solanidæ, Xenophoridæ, Velutinidæ, Cancellariadæ, Aporrhaidæ, Cerithiidæ, and Cerithiopsidæ, seventy-five species in all.——The worm *Gordius verrucosus*, obtained by Mr. Johnston on Kilimanjaro, is found also in South Africa, Ceylon and Central America.——A river-crab from Kilimanjaro is by Mr. E. J. Miers referred, with some hesitation, to *Thelphusa depressa*.

Batrachia and Reptilia.—Mr. W. B. Spencer contributes (Quart. Jour. Mic. Soc., 1885) some notes on the early development of *Rana temporaria*, with especial reference to the fate of the blastopore, and the development of the cranial nerves, which seems to be a more ancestral process than the method of their development in Elasmobranchs and birds.——G. A. Boulenger describes (P. Z. S., 1885, 22) a new species of frog, *Rana macronemis*, from Asia Minor. Its nearest ally is *R. temporaria*.——*Lepidosternon polystegum* is a Brazilian amphisbænoid with a sharp-edged cutting snout and singular scutellation of the top of the head. By means of its snout it has been known to cut its way through the side of a coral snake which had swallowed it.

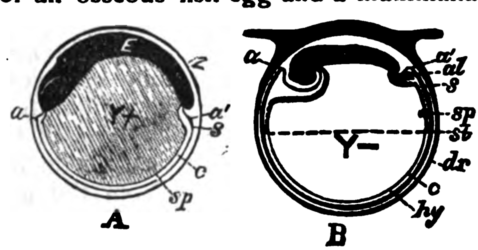
Birds.—Mr. T. H. Guillemard (Proc. Zoöl. Soc. Lon. 1885), gives a provisional list of the birds known to inhabit the Sulu archipelago. These are sixty-five in all, including sixteen previously listed by Mr. Sharpe. If birds of wide distribution are deducted, thirty-nine species are left, out of which thirty are formed in the Phillipines.——Professor W. Watson has contributed to the Proc. Zoöl. Soc. London some interesting notes on Peruvian birds. He has rediscovered the cliff-swallow, *Petrochelidon ruficollis* Peale. This bird was long searched for in the Andean valleys, and was ultimately found close to Lima. The nest is always found on human habitations. *Psittacula andicola* is a parrot which is peculiar to the higher parts of the western valleys of Peru, and occurs in the valley of the Rimac wherever vegetation is on the mountain sides. *Cypselus andicola* inhabits the western valleys of the Peruvian Andes from 6000 to 13,000 feet. The birds brought by Mr. H. H. Johnston from Kilimanjaro include fifty species, of which six, *Muscicapa johnstoni*, *Pinarochroa hypospadia*, *Pratincola axillaris*, *Nectarinea johnstoni* and *kikimensis* and *Cinniris mediocris*, are new to science. The second of these occurs at a height of 14,000 feet; the third at 10,000; the fourth at 11,000, and the last at 12,000. Few of the remaining species reach these great elevations, but *Palumbus arquatrix*, attains 10,300 feet, and *Corvultur albicollis* reaches up to the snow-line.——Mr. F. E. Beddard divides the Cuculidæ into Cuculinæ, with the genera Cuculus, Chrysococcyx, Cacomantis, and Coccystes? from the Old World, and Saurothera, Diplopterus, Piaya and Coccyzus from the New; Phenicophainæ, with the Old World genera, Phenicophæs and Endynamis; and Centropodinæ, with Pyrrhocentor, Centropus and Coua from the Old World, and Geococcyx, Crotophaga aud Guira, from the New.

Mammals.—Mr. Sidebotham (Proc. Zoöl. Soc. London, 1885) gives a detailed account of the myology of the water opossum, *Chironectes variegatus.*——The discovery of the wild cat (*Felis catus*) in Ireland, is often reported, but investigation has always shown that the supposed wild cat was but a feral specimen of the domestic cat.——A leopard skin in which most of the rosettes are replaced by black spots, numerous and of small size, has been brought from South Africa, and is the first African species which exhibits the tendency to melanism so strongly developed in some Asiatic individuals.——Mr. O. Thomas (P. Z. S. 1885, 329), distinguishes three varieties of the echidna, viz: *E. lawesi, aculeata* and *setosa.* The only remaining recent species of the family is *Taglossa bruijni,* a larger animal, found in Northwestern New Guinea.——A new species of paca (*Cœlogenys taczonowski*) is described by Sulzmann, who obtained it in Western Ecuador, where it inhabits mountains between 6000 and 10,000 feet above the sea. Like the well-known paca, it digs a burrow with two openings. The native name is Sacha-cui.

EMBRYOLOGY.[1]

The Origin of the Amnion.—The purpose of the present note is to point out some of the mechanical conditions and causes which have been competent, in the course of the *development of development,* to bring about the formation of the amnion. No embryological writer, as far as I am aware, has ever attempted to trace the amnion to the part in the embryos of anamniated forms which led up to its development in the amniated ones. Balfour said, that "it does not seem possible to derive it from any pre-existing organ" (Comp. Embryol., II, 256). And he says further (op. cit., 257): "The main difficulty is the early development of the head-fold of the amnion." Balfour's view, that it is developed *pari passu* with the outgrowth of the allantois, is utterly inadequate to explain the genesis of the amnion of insects or that of *Peripatus edwardsii* and *P. torquatus,* for in them no allantois is formed. His hypothesis also breaks down in the light of the brilliant researches of Selenka on the inversion of the layers in the Rodentia.

A comparison of the longitudinal, vertical, diagrammatic sections, figures *A* and *B*, of an osseous fish-egg and a mammalian ovum respectively, will conclusively show that the somatopleure *s*, in *A*, is the exact homologue of the layer giving rise to the amniotic folds in *B*, though in *A* this layer merely covers the space



[1] Edited by John A. Ryder, Smithsonian Institution, Washington, D. C.

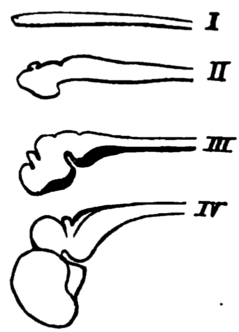
between the yolk *y* and the somatopleure, leaving the cœlomic space *c*, which has been derived directly in the osseous fish embryo from the cleavage cavity of the egg. We thus find that the preëxisting structure, from which the amniotic folds are formed in the higher types, is already present in the embryos of osseous fishes. The next important point to demonstrate is, at what grade in the phylum of the Chordata traces of amniotic folds first appear, and whether such rudiments of an amnion are also found in the embryos of osseous fishes.

Glancing at *A*, it will be seen that there are rudimentary amniotic head and tail folds developed at *a* and *a'*, and that we, therefore, have traces of an amnion appearing for the first time in embryos of the grade of osseous fishes. This is not universal, however, for it is found that in species in which the zona radiata *z* does not closely invest the ovum, the embryo *E* is not pressed down into the vitellus, so as to raise the somatopleure *s* into a fold or duplicature around the ends and along the sides of the embryo. The zona invests the ovum more or less closely in almost all Teleosts, but in a few, Alosa, for example, it does not, and in this species no traces of amniotic folds are ever developed.

The embryo is differently conditioned in those eggs with the zona fitting closely around the ovum from those in which there is a great space around the egg, and between the latter and the zona. The inference, therefore, is that in the first case the embryo *E* is pressed down mechanically into the yolk by the presence externally of the rigid zona. As the embryo *E* grows, and the yolk substance of the ovum is converted into it, the latter is replaced in the space within the zona by the embryo. It is thus rendered evident, that, in those types of teleostean ova with a closely fitting zona, the rudimentary amniotic folds which are formed around the embryo have been mechanically caused by the rigid zona in the presence of the active forces of growth. If we examine the mechanical conditions under which the eggs of still higher forms are placed, we will find the same reasoning to hold. We are thus, it seems, obliged to conclude that the amnion in all forms has arisen in consequence of the forces of growth resident in the embryo, encountering peripheral and external resistance either in the form of a rigid outer egg-shell, zona radiata *z*, or decidua reflexa *dr*, or even the walls of the uterine cavity itself, supposing, of course, that a large vesicular blastoderm containing yolk has been formed by epiboly.

The gap between the truly epicyemate embryo, as seen in Alosa, and the endocyemate embryo of the Paratheria and Eutheria is, therefore, partly bridged by the presence of a rudimentary amnion, or amniotic folds in many teleostean embryos just prior to their escape from the eggs, or where the zona is ruptured. When this occurs the amniotic folds vanish, as in the embryos of many of the Salmonidæ, for example, and a closed amniotic sack is never formed, because, in the first place, the intra-oval period of development does not last long enough; nor, in the second place, is it possible, owing to the comparative small size of the yolk, and the rapid growth of the embryo, for the latter to become bodily invaginated into the blastodermic vesicle, which is filled with yolk. The amniotic folds can, therefore, not meet upon the middle line of the back, and coalesce, as they do in the higher endocyemate forms. The development of a transient amniotic head-fold of greater width and in advance of the side and tail folds, is also prevented by the absence of a strongly marked cranial flexure in the embryos of Teleosts.

The mechanical effect of the gradual development of the cranial flexure in exaggerating the development of the amniotic head-fold in the Chordata, will be best appreciated by a glance at diagrams I, II, III, and IV, representing respectively the brain of an acraniate, a marsipobranch, an elasmobranch and a mammal. With the increase in the volume and area of the cerebral cortex, which occurs mainly on the dorsal and lateral aspects of the anterior end of the neurula, the acceleration of growth of the brain substance also occurs on those aspects, and a downward flexure of the floor of the brain necessarily takes place. The rapid enlargement of the cephalic end of the embryo of an endocyemate, eutherian or paratherian form, and the rapid or precocious development of the cranial flexure, would naturally, in such a type, tend to cause the amniotic head-fold to be developed earlier and to a greater extent than the tail-fold, as is shown in Fig. *B*, at *a*.



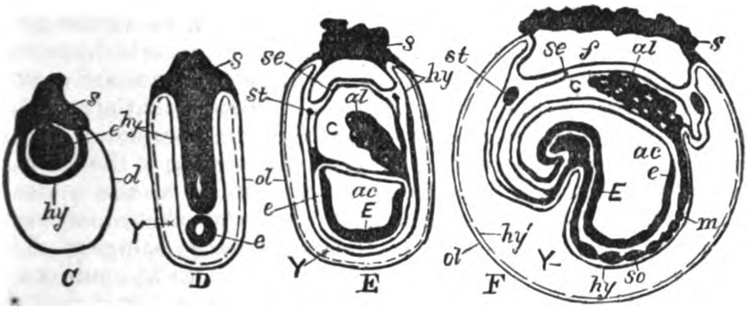
In the eutherian types, with inverted germinal layers, an amniotic head-fold of the kind developed in normal forms is never formed, because the cavity of the true amnion in the former is developed by the vacuolization or the formation of a cavity or cavities in the solid epiblastic mass, and not by invagination. In the Tracheates possessing an amnion there is no cephalic flexure, and the part of the amnion which is first developed in the most pronouneed manner is often the tail-fold, due apparently to the ingrowth of the caudal end of the embryo into an involution of the blastoderm, confined in a rigid egg-envelope, the involution being thrust into the yolk. Later, with the growth and encroachment of the head-end of the embryo upon the yolk, the abdomen is again everted in some cases from its amniotic sack. In *Peripatus edwardsii*, according to Von Kennel, cleavage is total, the development is viviparous and intra-uterine, a hollow blastula is formed, the embryonic area at one pole of the blastula is invaginated into the latter, so that the ventral surface of the embryo is directed towards the roof of the amniotic cavity, the reverse of the eutherian embryo. An umbilical stalk is also formed, which springs from the dorsal surface of the embryo and passes to a partially zonary placenta, disposed in relation to the uterine walls in exactly the same way as that seen in the embryo of Carnivora. If we now regard the dorsal surface of the embryo of *Peripatus edwardsii* as homologous with the ventral surface of the embryos of Carnivora, the resemblance between the modes of development of these two types becomes still more startling. While it is manifestly absurd to even attempt to suppose, on the strength of these resemblances, that there could be any genetic affiliation between the Carnivora and Malacopoda, the only way out of the difficulty seems to be to suppose that the similar methods of development of the two arose in response to the similar conditions which environ the ovum during its early stages of growth.

The differences between Von Kennel and Sedgwick, as to the modes of development of *P. edwardsii* and *P. capensis*, it seems to me, may be readily understood and reconciled when it is considered that the first is holoblastic and endocyemate, while in the latter the egg is meroblastic, and apparently undergoes an epicyemate process of development.

All the data in the foregoing paragraphs unequivocally support the thesis that the amnion has been developed mainly by mechanical means and conditions.

The rigid zona of the epicyemate teleostean embryo, as shown in Fig. *A*, in which the yolk *y* is a positive quantity, is represented by the maternal envelope *dr* in Fig. *B*, in which the yolk, as such, is absent. The gap between the condition of *A* and that of the types with apparently inverted germinal layers, so completely elucidated by Selenka, is a wide one; yet it seems easy to pass from the primitive condition of *A* to that of the extremest form, viz., the guinea-pig; if the rabbit, mole (Heape), the vole (Kupffer), and the mouse and rat (Selenka), are considered as intermediary steps. So complete or extreme has been the invagination of the embryonic mass or area in these forms that, in the extremest type, the embryo is finally developed at that side or pole of the primitive blastula which is exactly opposite the point where the blastodisk was originally formed, as in normal Eutheria. The way in which this is accomplished is quite remarkable, and may now be described, as the process is a special modification of that by means of which the usual endocyemate condition is brought about.

Selenka finds that there is an outer layer of cells, *ol*, Fig. *C*, split off from the ectoblast, as first described by Rauber, in the rabbit's ovum, and which take no direct part in the formation of the embryo. He also finds that upon the further growth of the ovum, after the blastula stage is reached and the germinal area or disk is developed, the blastula rapidly elongates in the direction of the diameter extending from the centre of the blastodisk to the opposite pole. By this time the blastula has become



adherent to the uterine epithelium through the intermediation of the transitory outer layer of cells, *ol* (*Reichert'sche Deckschicht*), already mentioned, but the constituent cells of a certain portion of this outer layer, just overlying the germinal disk, as indicated at *s*, rapidly proliferate, so as to form a lenticular or columnar thickening or mass, constituting what Selenka calls the *Träger*, a term which may be anglicized by the word *suspensor*. This suspensor immediately overlies and pushes the germinal area or mass inwards before it, down into the hollow cavity of the blastula. The germinal area is either pressed inwards into the hollow blastula, so that it assumes a concave form above, with a cavity between it and the lower surface of the suspensor, as in Arvicola, or the epiblast forms a solid mass, before which the hypoblast is pushed inwards by the ingrowth of the suspensor, so that the blastula assumes the form of an elongated sack, as in the ovum of the rat or the guinea-pig.

The process just described is somewhat similar to that of gastrulation, for the germinal pole of the blastula is pushed downward into the sack formed by the hypoblast and outer layer, so that the embryo is finally developed quite at the opposite pole of the elongated blastula, as in the guinea-pig. The steps by which the mode of development of the embryo of the latter came to be established will be much better understood by reference to diagrams *C*, *D*, *E*, and *F*, representing four stages of the development of the rat copied from Selenka.[1] In these figures it will be obvious to the reader that the principal result of the precocious invagination of the embryonic area is to throw the embryo to the opposite pole of the egg, and to so encroach upon the cavity of the mesenteron, the umbilical vesicle, as to almost obliterate it, as is shown in Fig. *F*. The embryo *E* is also bent into a curve, just the reverse of that shown in Fig. *B*. The cœlomic space *c* is also more restricted, and the sinus terminalis *st*, in Fig. *F*, seems to

[1] Studien über Entwickelungsgeschichte der Thiere. Drittes Heft. Die Blätter-umkehrung im Ei der Nagethiere, 4to. Wiesbaden, Kreidel, 1884.

terminate towards the dorsal pole of the ovum instead of the ventral, as in Fig. *B*.

In the ovum of the guinea-pig the obliteration of the umbilical vesicle *y* is carried still farther than in Fig. *F*, because the hypoblastic layer *hy'*, next to the layer *ol*, is absent, and the hypoblast lying just under the embryo is brought into immediate contact with the layer *ol*, thus giving rise to the illusion that a complete inversion of the primary embryonic layers has occurred. I say illusion, because there has been no actual inversion of the primary layers, for the latter have been merely shoved to the opposite pole of the eggs into contact with the layer *ol*, where embryonic development has proceeded in the normal way, being modified only by the displacement which the germinal area has suffered in relation to the other essential parts of the ovum. It is as if the germinal pole of the blastodermic vesicle had become concave instead of convex, and collapsed inwards against the inside of its lower pole, the walls of which consist of the hypoblast of the inferior pole of the umbilical vesicle—mesenteron, and the outer layer.

The difficulties which Balfour speaks of have, I hope, been satisfactorily cleared away by what has been said above, and a rational and connected hypothesis as to the genesis of the amnion firmly established. I am aware that many objections may be urged against the views here propounded, but I cannot think that any other view of the case will so satisfactorily reconcile and coördinate the facts involved. To those who take a philosophical view of such subjects, it will be obvious that the deductions here reached give but little countenance to the idea that amniotic characters can be always profitably used in taxonomy, at least, not until the forces which have led to their development are better understood. On the theory of the development of development, the extreme modification of the amnion of some of the Rodentia would cause the latter to take higher rank than the Primates, because, as shown in Fig. *F*, the primary amniotic cavity becomes divided, and a relatively large false amniotic cavity *f* remains just under the suspensor *s*, and shut off from the true amniotic cavity *ac* by the intervening serous envelope *se*, the cœlomic space *c*, and the somatopleural roof of *ac*. Such reasoning, however, is obviously not legitimate in the light of the above mechanical hypothesis of the genesis of the amnion.

To briefly summarize, we find that the first traces of amniotic folds met with in the embryos of the lower types of Chordata are caused by the resistance from without offered to the growth of the embryo by a rigid zona radiata. In such types the amniotic folds are transitory, and disappear at the time the zona is ruptured. After a larger yolk has been acquired the embryo undergoes a longer period of intra-oval development, so that the period of the persistence of the amniotic folds, produced as before, is prolonged.

With the increase in the size of the embryo, in these large-yolked forms, it is finally thrust down into a saccular involution of the blastoderm, the lips of the opening of which meet over the back of the embryo where they coalesce, the outer limb of the duplicature giving rise eventually to the serous envelope, and the inner to the roof of the amniotic cavity. In those types which have the primary layers apparently inverted, the rapid ingrowth of the suspensor precociously invaginates the germinal area inwards before the embryo is distinctly developed, so that it is not formed in its usual or normal position. These extreme modifications were not possible until after the loss of the food-yolk, after which a hollow blastodermic vesicle still continued to develop, filled with a thin albuminous or serous fluid instead of a dense yolk material. The tendency of the eutherian ovum to form a large, hollow blastodermic vesicle or blastula is doubtless an inheritance transmitted from a paratherian source. The bodily invagination of the whole embryo, and the more or less complete obliteration of the cavity of the umbilical vesicle by the rapid growth of the enlarging amnion, would be readily accomplished in the course of the development of the eutherian ovum.

EXPLANATIONS OF THE REFERENCE LETTERS USED IN THE FIGURES.

a amniotic head-fold, *a'* tail-fold, *ac* amniotic cavity, *al* allantois, *c* cœlomic space or continuation of body cavity, *dr* decidua reflexa of uterus, *E* embryo, *e* epiblast, *f* cavity of false amnion (*falsche amnionhöhle*), *hy* hypoblast, *hy'* hypoblastic outer wall of umbilical vesicle, *m* mesoblast, *ol* outer layer (*Reichert'sche Deckzellen, Deckschicht*), *s* suspensor (*Träger*), *se* serous envelope, *so* muscular somites, *sp* splanchnopleure (= the periblast in Fig. *A*), *st* sinus terminalis, *Y* yolk, with + and — signs to indicate its presence or absence.

—*John A. Ryder.*

DECEMBER 31, 1885.

PHYSIOLOGY.[1]

THE EXISTENCE OF TWO KINDS OF SENSIBILITY TOWARD LIGHT. —MM. Charpentier and Parinaud, working independently, have concluded that visual sensations involve two distinct kinds of physiological processes. Sensations of one kind are "photesthetic" and involve luminous sensations pure and simple, merely discriminating light in distinction to darkness. The other sensations are truly "visual" and are necessary to the perception of color, of form, and to distinctness of vision. The first kind of sensation is supplied by the excitement of the rods of the retina through the chemical disintegration of the "visual purple," which is found in their outer segments. The power of giving rise to the second kind of sensations is confined to the retinal cones which wholly compose the bacillary layer of the fovea centralis, but which relatively decrease in number with reference to the rods as we recede from this area. Parinaud declares that the increase of sensibility of the retina to small differences of luminosity when the amount of objective light is extremely small is confined

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.

to the area outside the fövea centralis. This increase of sensibility is proportionately greater toward the more refrangible rays. This fact affects the tone of colors, and on account of it the luminosity of (the more refrangible ?) colors is increased at the expense of their saturation. The reader may be reminded, as an interesting confirmation of this view that, when alternate circles, painted blue and red, are looked at in obscurity, the former appear luminous and the latter black. Visual purple is bleached by light and is regenerated under the influence of the pigmentary layer of the retina in the dark. In these facts we have an explanation of the varied sensibility toward light of different intensities.—*Comptes Rendus, 1885, p. 821.*

The Circulation in Ganglion Cells.—A most curious discovery, if it be confirmed, is that announced by Adamkiewicz concerning the supply of blood to nerve ganglion cells. In his researches on the blood-vessels of the spinal cord, the author found that the richness in capillaries was directly proportional to the number of nerve-cells. His more special investigations of this relation were made on the intervertebral ganglia taken from injected animals. The nerve-cells composing these ganglia are each inclosed in a connective-tissue capsule, lined by flattened cells and having two tubular prolongations from it. The nerve-cell itself is inclosed in a special sac of flattened cells and possesses two prolongations which reach out into those of the surrounding connective-tissue capsule. Between the latter capsule and the cell is a rather roomy space, and there is also a much narrower one between the substance of the cell and its own epithelial covering. The arterial blood enters by an afferent vessel into the pericellular space and leaves it by a much narrower efferent vessel. The blood thus surrounds the cell under pressure and its liquid portions pass actively by osmosis into the substance of the cell itself, in the centre of which they are received by an empty space. This empty space is nothing else than what has so long been regarded as the nucleus of the cell. This space belongs to the venous system with which it is in connection by a minute vessel having its own proper wall. A solid body, hitherto called the nucleolus, is suspended fixed in the centre of the nuclear cavity.—*Comptes Rendus, 1885, p. 826.*

Pasteur's Method for the Prevention of Hydrophobia.—In the *Comptes Rendus* for October, 1885, is the latest report of Pasteur's experiments upon the prophylaxis of hydrophobia. The following is an outline of his procedure: When a small particle of the spinal cord of a dog dead from rabies (*moelle rabique*) is placed under the dura mater of a rabbit the animal always falls a victim to hydrophobia after a period of incubation which lasts some fifteen days. When virus from the first rabbit is transferred in the same way to a second and, after the period of incubation is passed, that from the second to a third rabbit and so on, the duration of the period of incubation becomes more and more reduced. After the successive inoculation of twenty to twenty-five rabbits, the time of incubation is reduced to some eight days, and the incubation period remains of this length throughout a further series of twenty to twenty-five successive inoculations; then the time of incubation is shortened to seven days, which is maintained with remarkable regularity throughout a new series of ninety inoculations. Pieces of the spinal cords of these rabbits induce hydrophobia with constant virulence. When the diseased cord is detached from a rabbit under the strictest precautions against contamination by impurities, and is suspended in a flask, the air of which is kept dry by caustic potash on the bottom, its virulence gradually disappears and may become wholly lost. The virulence fails somewhat more slowly the larger the piece of marrow exposed, and is preserved longer the lower the temperature. These facts being established, the following procedure proved successful in rendering dogs resistant to the influence of inoculation with the most potent virus. Pieces of spinal marrow from rabbits dead of hydrophobia which had appeared after seven days' incubation, were suspended in a series of flasks the air in which was maintained dry. As stated above, the virulence of each specimen diminished progressively with its exposure. Sterilized bouillon was inoculated with a small portion of cord which had been exposed for such a time that the loss of its virulence was certain, and a small syringe full was injected under the skin of a dog. On each day following a similar operation was performed, using, however, at each injection, spinal cord which had been exposed for a shorter time and which possessed, therefore, progressively increasing virulence. When this procedure had been repeated until the dog had received an injection of virus which had been exposed to dry air only one or two days, the animal was found to be perfectly protected against hydrophobia, and might with impunity be inoculated with the strongest virus. Fifty dogs were thus made resistant to the disease without a single failure, besides which a number were successfully inoculated after having been bitten by rabid animals. A child which had been lacerated by a mad dog two days before and whose wounds had been cauterized with carbolic acid two hours after the injury, was brought to Pasteur for treatment. The method pursued was similar to that described, and the final inoculation was with virus more virulent than that of ordinary rabies. Three months and three weeks after the accident the child was still well. Pasteur explains his results by supposing that the products formed by the vital activity of the germs of the disease are poisonous to the germs themselves. These products are gradually set free by the action of the "attenuated" virus, and accumulate in the body in sufficient quantities to render the development of the strongest virus impossible.

PSYCHOLOGY.

Sir J. Lubbock on the Intelligence of the Dog.—Before a crowded sitting of the biological section of the British Association, Sir John Lubbock read a paper in which he gave some interesting notes on the intelligence of the dog. The man and the dog, he said, have lived together in more or less intimate association for many thousands of years, and yet it must be confessed that they know comparatively little of one another. That the dog is a loyal, true, and affectionate friend must be gratefully admitted, but when we come to consider the psychical nature of the animal, the limits of our knowledge are almost immediately reached. I have elsewhere suggested that this arises very much from the fact that hitherto we have tried to teach animals rather than to learn from them—to convey our ideas to them rather than to devise any language or code of signals by means of which they might communicate theirs to us. The former may be more important from a utilitarian point of view, though even this is questionable, but psychologically it is far less interesting. Under these circumstances, it occured to me whether some such system as that followed with deaf-mutes, and especially by Dr. Howe with Laura Bridgman, might not prove very instructive if adapted to the case of dogs. I have tried this in a small way with a black poodle named Van. I took two pieces of card-board, about ten inches by three inches, and on one of them printed in large letters the word "food," leaving the other blank. I then placed two cards over two saucers, and in the one under the "food" card put a little bread and milk which Van, after having his attention called to the card, was allowed to eat. This was repeated over and over again till he had had enough. In about ten days he began to distinguish between the two cards. I then put them on the floor and made him bring them to me, which he did readily enough. When he brought the plain card I simply threw it back, while when he brought the "food" card I gave him a piece of bread, and in about a month he had pretty well learned to realize the difference. I then had some other cards printed with the words "out," "tea," "bone," "water," spelt phonetically so as not to trouble him by our intricate spelling, and a certain number also with words to which I did not intend him to attach any significance, such as "nought," "plain," "ball," &c. Van soon learnt that bringing a card was a request, and soon learned to distinguish between the plain and printed cards; it took him longer to realize the difference between words, but he gradually got to recognize several, such as food, out, bone, tea, &c. If he was asked whether he would like to go out for a walk, he would joyfully fish up the "out" card, choosing it from several others and bring it to me, or run with it in evident triumph to the door. I need hardly say that the cards were not always put in the same places. They were varied quite indiscriminately and in a great variety of positions. Nor could the dog recognize them by scent. They were all alike, and all continually handled by us. Still I did not trust to that alone, but had a number printed for each word. When for instance, he brought a card with "food" on it, we did not put down the same identical card, but another bearing the same word; when he had brought that a third, then a fourth, and so on. For a single meal, therefore, eighteen or twenty cards would be used, so that he evidently is not guided by scent. No one who has seen him look down a row of cards and pick up the one he wanted could, I think, doubt that in bringing a card he feels he is making a request, and that he can not only distinguish one card from another, but also associate the word and the object. This is, of course, only a beginning, but it is, I venture to think, suggestive, and might be carried further, though the limited wants and aspirations of the animals constitute a great difficulty. My wife has a very beautiful and charming collie, Patience, to which we are much attached. This dog was often in the room when Van brought the "food" card, and was rewarded with a piece of bread. She must have seen this thousands of times, and she begged in the usual manner, but never once did it occur to her to bring a card. She did not touch or indeed even take the silghtest notice of them. I then tried the following experiment: I prepared six cards about ten inches by three inches, and colored in pairs—two yellow, two blue, two orange. I put three of them on the floor, and then holding up one of the others, endeavored to teach Van to bring me the duplicate. That is to say that if the blue was held up, he should fetch the corresponding color from the floor; if yellow, he should fetch the yellow, and so on. When he brought the wrong card he was made to drop it, and return for another till he brought the right one, when he was rewarded with a little food. The lessons were generally given by my assistant, Miss Wendland, and lasted half an hour, during which time he brought the right card on an average about twenty-five times. I certainly thought that he would soon have grasped what was expected of him. But no. We continued the lessons for nearly three months, but, as a few days were missed, we may say ten weeks, and yet at the end of the time I cannot say that Van appeared to have the least idea what was expected of him. It seemed a matter of pure accident which card he brought. There is, I believe, no reason to doubt that dogs can distinguish colors; but as it was just possible that Van might be color blind, we then repeated the same experiment, only substituting for the colored cards others marked repectively I, II and III. This we continued for another three months, or say, allowing for intermission, ten weeks, but to my surprise entirely without success. I was rather disappointed at this, as, if it had succeeded, the plan would have opened out many interesting lines of inquiry. Still, in such a case, one ought not to wish for one result more than another, as of course the object of all such experiments is merely to elicit the truth, and our result in the present case, though negative, is very interesting. I do not, however, regard it as by any means conclusive, and should be glad to see it repeated. If the result proved to be the same, it would certainly imply very little power of combining even extremely simple ideas. I then endeavored to get some insight into the arithmetical condition of the dog's mind. On this subject I have been able to find but little in any of the standard works on the intelligence of animals. Considering, however, the very limited powers of savage men in this respect—that no Australian language, for instance, contains numerals even up to four, no Australian being able to count his own fingers even on one hand—we cannot be surprised if other animals have made but little progress. Still, it is surprising that so little attention should have been directed to this subject. Leroy, who, though he expresses the opinion that "the nature of the soul of animals is unimportant," was an excellent observer, mentions a case in which a man was anxious to shoot a crow. "To deceive this suspicious bird, the plan was hit upon of sending two men to the wash-house, one of whom passed on, while the other remained; but the crow counted and kept her distance. The next day three went, and again she perceived that only two retired. In fine, it was found necessary to send five or six men to the watch-house to put her out in her calculation. The crow, thinking that this number of men had passed by, lost no time in returning." From this he inferred that crows could count up to four. Lichtenberg mentioned a nightingale which was said to count up to three. Every day he gave it three meal-worms, one at a time; when it had finished one it returned for another, but after the third it knew that the feast was over. I do not find that any of the recent works on the intelligence of animals, either Buchner, or Peitz or Romanes in either of his books, give any additional evidence on this part of the subject. There are however various scattered notices. There is an amusing and suggestive remark in Mr. Galton's interesting Narrative of an Explorer in Tropical South Africa. After describing the Damara's weakness in calculations, he says: "Once while I watched a Damara floundering hopelessly in a calculation on one side of me, I observed Dinah, my spaniel, equally embarrassed on the other; she was overlooking half a dozen of her new-born puppies, which had been removed two or three times from her, and her anxiety was excessive, as she tried to find out if they were all present, or if any were still missing. She kept puzzling and running her eyes over them backwards and forwards, but could not satisfy herself. She evidently had a vague notion of counting, but the figure was too large for her brain. Taking the two as they stood, dog and Damara, the comparison reflected no great honor on the man." But even if Dinah had been clear on this subject, it might be said that she knew each puppy personally, as collies are said to know sheep. The same remark applies generally to animals and their young. Swans, for instance, are said to know directly if one of their cygnets is missing, but it is probable that they know each young bird individually. This explanation applies with less force to the case of eggs. According to my bird-nesting recollections, which I have refreshed by more recent experience, if a nest contains four eggs, one may safely be taken; but if two are removed, the bird generally deserts. Here then, it would seem as if we had some reason for supposing that there is sufficient intelligence to distinguish three from four. An interesting consideration rises with reference to the number of the victims allotted to each cell by the solitary wasps. Ammophila considers one large caterpillar of *Noctura segetum* enough; one species of Eumenes supplies its young with five victims; another ten, fifteen, and even up to twenty-four. The number appears to be constant in each species. How does the insect know when her task is fulfilled? Not by the cell being filled, for if some be removed she does not replace them. When she has brought her complement she considers her task accomplished, whether the victims are still there or not. How then does she know when she has made up the number twenty-four? Perhaps it will be said that each species feels some mysterious and innate tendency to provide a certain number of victims. This would under no circumstances be any explanation, but it is not in accordance with the facts. In the genus (Eumenes) the males are much smaller than the females. Now, in the hive bees, humble-bees, wasps, and other insects, where such a difference occurs, but where the young are directly fed, it is of course obvious that the quantity can be proportioned to the appetite of the grub. But in insects with the habits of Eumenes and Ammophila the case is different, because the food is stored up once for all. Now, it is evident that if a female grub was supplied with only food enough for a male, she would starve to death; while if a male grub were given enough for a female it would have too much. No such waste, however, occurs. In some mysterious manner the mother knows whether the eggs will produce a male or female grub, and apportions the quantity of food accordingly. She does not change the species or size of her prey; but if the egg is male she supplies five, if female ten, victims. Does she count? Certainly this seems very like a commencement of arithmetic. At the same time it would be very desirable to have additional evidence how far the number is really constant. Considering how much has been written on instinct, it seems surprising that so little attention has been directed to this part of the subject. One would fancy that there ought to be no great difficulty in determining how far an animal could count; and whether, for instance, it could realize some very simple sum, such as that two and two make four. But when we come to consider how this is to be done, the problem ceases to appear so simple. We tried our dogs by putting a piece of bread before them and prevented them from touching it until we had counted seven. To prevent ourselves from unintentionally giving any indication, we used a metronome (the instrument used for giving time when practicing the pianoforte), and to make the beats more evident we attached a slender rod to the pendulum. It certainly seemed as if our dogs knew when the moment of permission had arrived; but their movement of taking the bread was scarcely so definite as to place the matter beyond a doubt. Moreover, dogs are so very quick in seizing any indication given them, even unintentionally, that, on the whole, the attempt was not satisfactory to my mind. I was the more discouraged from continuing the experiment in this manner by an account Mr. Huggins gave me of a very intelligent dog belonging to him. A number of cards were placed on the ground numbered respectively 1, 2, 3, and so on up to 10. A question is then asked: the square root of 9 or 16, or such a sum as $6 \times 52-3$. Mr. Huggins pointed consecutively to the cards, and the dog barked when he came to the right one. Now Mr. Huggins did not consciously give the dog any sign, yet so quick was the dog in seizing the slightest indication that he was able to give the correct answer. This observation seems to me of great interest in connection with the so-called "thought reading." No one, I suppose, will imagine that there was in this case any "thought reading" in the sense in which this word is used by Mr. Bishop and others. Evidently "Kèpler" seized upon the slight indication unintentionally given by Mr. Huggins. The observation, however, shows the great difficulty of the subject.

I have ventured to bring this question before the section, partly because I shall be so much obliged if any lady or gentleman present will favor me with any suggestions, and partly in hope of inducing others with more leisure and opportunity to carry on similar observations, which I cannot but think must lead to interesting results.—*English Mechanic.*

ANTHROPOLOGY.[1]

SOME MOOT POINTS IN AMERICAN ARCHÆOLOGY.—American archæological science, though continuously gathering strength, is, nevertheless, in a sense still far from manly development. There are celebrated institutions guarding with jealous care objects of inestimable worth; preëminent among these, the American Antiquarian Society (to commence with the oldest), the Smithsonian Institution, the Peabody Museum, the American Museum of Natural History, the Davenport Academy of Sciences, as well as those at Cincinnati and St. Louis; there are smaller institutions whose collections are of almost equal value to those above mentioned, and private museums filled with the richest material.

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

In the first place, though these institutions are presided over by men of great ability, there is a deplorable lack of mutual understanding and uniformity of method among them. There should be between those who hold in trust such vast treasures a better scientific method, a more wholesome comity of intercourse. In short, before we draw inferences we should know what and what kind of material we have in hand.

In the second place, investigations have been so increasingly fraught with grand results that some of the first efforts are likely to be ignored or forgotten. There are some points in the history of Squier's and Davis' work that have been misunderstood, and as the venerable authors are yet living it would seem a grateful tribute to bear them in mind. The earliest explorations of any great importance in the tumuli of the Ohio valley were made by Dr. Davis, who commenced a series of mound excavations while a student in Kenyon College from 1829 to 1833. The result of this first effort was published in some of the college papers.

Subsequently, Dr. Davis removed to Chilicothe, in the Scioto valley, celebrated for its earthworks. Here he laid out his plans for the great work which will forever be associated with his name.

After ten years of digging, plotting, mapping, and collecting, Dr. Davis was associated with Mr. Squier, and the fruit of their joint labors is the first Smithsonian contribution to knowledge, entitled "Ancient Monuments of the Mississippi Valley." When these first discoveries were made, comparatively little interest was manifested in American archæology. The objects recovered by the explorations of Squier and Davis, instead of remaining at home, were allowed to go abroad for want of a purchaser here. No one series of efforts since made approaches the latter in its detail and great results.

Recently the accuracy of the work done by Squier and Davis has been challenged, and this brings us to another phase of the question. Fully realizing the importance of criticism at any and all times, we still hold that a very important matter has been overlooked; it is this: The works of the mound-builders of a particular character or grade have not been compared with works of the same grade by their successors. If some of the best productions of artistic handicraft of the present Indians be compared with objects of a similar nature taken from the mounds it is more than doubtful if the superiority of the latter-day Indians can be substantiated. Generally woodcuts are published in this connection to show the low condition of the mound-builders' art. The cuts are copies of casts taken from inferior examples. Not one of the fine examples of mound-builders' work in hard stone has been figured in these comparisons. A few of the choicest specimens of this art are now in the possession of the Museum of Natural History, New York; others may be seen in almost every good cabinet in the country.

Now it is not a question of argument, but one of things. It is an easy matter to place things side by side, and there would be no question whatever of the superiority of mound-builders' work over that of every tribe known in historic times any where near the area occupied by them.

The pipes and other objects in hard stone should be compared not with pipes in catlinite and soapstone, but with objects in the same material.

The same is true of pottery. If we select from any or every collection the best evidences of form and finish and place by the side of them the best specimens of modern work by any tribe east of the Mississippi river there is a hopeless falling off.

Now it is but fair to infer that the people who so skilfully wrought in the hardest quartz, who made pottery in every way equal to that of the Pueblos, were not in the same grade as the tented savages whom our ancestors found upon our territory.

But the great, complicated earthworks of the mound-builders, so faithfully examined and reported by the old explorers, furnish the most important evidence of their superiority to their successors. It is true the southern Indians built mounds; but does any one seriously compare the works of the Natchez and Muskoki tribes with those of the mound-builders? The Iroquois made stockades and enclosures, and Mr. Morgan argued thence the works in Ohio were precisely similar in function. But this opinion cannot stand.

In conclusion, we desire to emphasize the importance of that pioneer work, so extended and so valuable to science. There are not many examples of such unselfish devotion. More than one hundred mounds were carefully opened, their contents gathered and arranged, over five hundred embankments and fortifications visited and surveyed in five States, the expense being borne by Dr. Davis. The magnitude and completeness of all this can only be appreciated by examination of "Ancient Monuments," and of the treasures collected, now in Blackmore Museum, London.—*J. B. Holder.*

An important Contribution to Californian Folk-lore, linguistics and tribal topography is contained in the Bulletin of the Essex Institute of Salem, Mass. Nos. 1–3 of Vol. XVII (1885), pp. 33, and one plate. The author, Hugo Ried, wrote a series of letters from San Gabriel Mission to Mr. Coronel of Los Angeles, in 1852, concerning the Indians among whom he lived at the mission buildings. Twelve of these letters were published by Dr. W. J. Hoffman in the above periodical, together with copious notes of his own and drawings of the implements described in the letters. The subjects referred to are births, burials, food, medicine, diseases, sports and games, myths and legends, etc., all of which form interesting parallels to Father Boscana's Chirigchinich (in Robinson's Life in California, 1846). The first letter gives the Indian equivalents to the names of towns, harbors and rancherias of the surrounding country; in letters 2, 3 and 4 are contained vocables, paradigms and the like of the San Gabriel language, which belongs to the Shoshondan family and has been variously termed Kish ("houses"), Tobikhar and San Gabriel dialect.—*A. S. Gatschet.*

KICHÉ GRAMMAR.—A short abstract of a *Kiché* grammar in Spanish, dated Santa Clara, Dec. 6, 1842, and composed by L. Aleman (pp. 26, 8vo), was sent by A. Blomme to the Congress of Americanists at Copenhagen (1883). The revises came in at so late a day that this elementary grammar could not be inserted in the Compte-rendu of that session, but the secretary ordered it to be struck off in a separate edition, a copy of which is before us. Mr. Blomme has given an historical account of the manuscript in the Compte-rendu, page 365. The grammar is written entirely in the old-fashioned way of the seventeenth and eighteenth centuries, when every missionary was sure to find the classifications and grammatic categories of Latin in any Indian language whatsoever. Aleman's Kiché cases of the noun, dative, ablative, etc., are simply postpositions connected with a noun; the verb *coh* is regarded as identical with the verb substantive, and a "subjunctive" is found to occur through all the tense-forms of this Guatemaltec language.—*A. S. Gatschet.*

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON, founded in 1879 by Dr. J. M. Toner, Professor Otis T. Mason and Col. Garrick Mallery, has just published its third volume of Transactions, extending from Nov. 6, 1883, to May 19, 1885. Among the papers included are the following, reported in full:

The Smithsonian anthropological collections for 1883. By Albert Niblack.

Discontinuities in nature's method. By H. H. Bates.

Elements in modern civilization. By J. M. Gregory.

Evidences of the antiquity of man on the site of the City of Mexico. By Wm. H Holmes.

How the problems of American anthropology present themselves to the English mind. By E. B. Tylor.

The Eskimo of Baffin land. By Franz Boas.

Seal catching at Point Barrow. By John Murdoch.

On the probable nationality of the mound-builders. By Daniel G. Brinton.

Moral and material progress contrasted. By Lester F. Ward.

The genesis of invention. By F. A. Seely.

Sinew-backed bow of the Eskimo. By John Murdoch.

From savagery to barbarism. Address by J. W. Powell, president.

Papers by Messrs. Kengla, Dorsey, Holmes, Blodgett, Thomas, Ward, Thompson, Gallaudet, Burnett, Reynolds, Howitt, Mindeleff, Matthews, Henshaw, Stevenson and Gatschet are given in abstract, but, as they will be published elsewhere in full, no mention of their contents will be made here.

Mr. Bates draws attention to the seeming chasms in nature, such as the passage from inorganic to organic life, from invertebrate to vertebrate, the introduction of the Mammalia, and followed the question into anthropology, noticing such breaks as the advent of man, and the phenomena of the inventive faculty.

Dr. Gregory discusses the phenomena of civilization from the side of human wants.

Mr. Holmes, during a visit to Mexico, had the good fortune to witness the making of a railroad cut and other excavations which revealed three periods—the ancient, the Aztec and the modern.

Mr. Tylor's delightful address has already appeared in *Science*.

Dr. Boas spent more than a year in Baffin land among the Eskimo visited by Capt. Hall and gave a sketch of the geography and ethnology of this region.

Mr. John Murdoch, for three years attached to the signal service at Point Barrow, Alaska, described the varied uses of the seal and the methods of capture with the retrieving harpoon, with the una harpoon and with the net, the most ingenious plan of all.

Dr. Brinton's short paper refers to the connection of the mound-builders with the Shawnees.

Professor Ward draws attention to the disharmony between material progress, or the accumulation of the means of happiness, and moral progress, or the ability to adapt these means to human well-being.

Colonel Seely presented an elaborate argument to show the application of modern methods of examining inventions to the early inventions of our race. The term eurematics was introduced for the study of the processes of invention in all human activities.

Major Powell's address was an elaborate analysis of culture or the humanities into arts, institutions, languages, opinions and intellections, and the discussion of the three great culture stages, savagery, barbarism and civilization, in relation to these forms of activities.

Ethnology of Borneo.—Everybody has heard of Professor Ward, of Rochester. Well, in 1876 he sent Mr. Wm. T. Hornaday to the East Indies equipped as a collector. This journey accomplished, after two years of wandering, the explorer returned to active work in his profession. He has found leisure, however, to write one of the most charming books of travels in India and Malaysia it has been our privilege to read. In this volume, Two Years in the Jungle, will be found excellent notes on the peoples of India and a thorough study of the people of Borneo.

The Dyaks are thus divided:

Kyans. All of the center and coming to the coast along the middle of the north-east shore.
Hill Dyaks. Uplands of north-west corner back of Sarawak.
Sea Dyaks. Uplands and coast east of Hill Dyaks.
Mongol Dyaks. Away from the coast in the entire north-east region.

The entire coast on the south-east and south-west side is left undescribed.

The tribes are as follows:

KYANS.	HILL DYAKS.	MONGOL DYAKS.
1. Kyans proper, (Baram, Rejang.)	1. Serambo.	1. Ida'an.
2. Milanaus.	2. Singgei.	2. Kadydu.
3. Kanowit.	3. Sentah.	3. Murut.
4. Ukit.	4. Selenkau.	4. Bisaya.
5. Bakatan.	5. Lara.	
6. Kiniahs.	6. Bukar.	
7. Skapan.	7. Engkroh.	
8. Maloh.	8. Engrat.	
9. Sibaru.	9. Milikin.	
10. Jankang.	10. Sou.	
11. Behoa.	11. Brang.	
12. Long Wai.	12. Sabungo.	
13. Long Wahoe.	13. Sinar.	
14. Modang.	SEA DYAKS.	
15. Tandjoeng.	1. Seribas.	
16. Saghai.	2. Saukarran.	
17. Eng'·aya.	3. Ballow.	
18. Tring.	4. Sibuyau.	
19. Kahajang.	5. Batang Ayer.	
20. Orang Bukkit.	6. Lamanak.	
21. Punan.	7. Bugau.	
	8. Kantu.	

THE ESKIMO OF POINT BARROW.—The hyperborean peoples of America are usually called Eskimo without reference to the locality where they are found, but there are Eskemo and Eskimo. For classification I find it convenient to divide their habitat as follows:

1. Greenland.
2. Labrador and Ungava.
3. Baffinland.
4. Mackenzie river.
5. Point Barrow.
6. Kotzebue sound.
7. Asiatic Eskimo.
8. Cape Nome.
9. Norton sound.
10. Nunivak.
11. Bristol bay.
12. Kadiak and the main land.

For each of these regions the National Museum has sufficient material to illustrate the arts of the people.

During the years 1881, 1882, 1883, Lieut. Ray, U. S. A., occupied Point Barrow with a party sent out by the Chief Signal Officer of the Army. The report of the International Polar Expedition to Point Barrow, Alaska, just issued by the Government printing office is the fruit of this enterprise. Lieut. Ray has a chapter on the inhabitants, but the linguistics and ethnology are the work of Mr. John Murdoch. Ten pages are devoted to the language of the people, Major Powell's alphabet and Introduction being followed closely. Twenty-six pages are occupied with a minute description of the collections, nearly 2000 specimens gathered with great care. In examining carefully this list and the accompanying drawings he was struck both with the generic similarities of hyperborean art and with the specific differences due to isolation. Pottery occurs in the list; labret lancets of slate for cutting the holes in the cheek for labrets; amber-beads made by the natives, and cups of fossil ivory. Of the implements, whose general form is widely diffused, Mr. Murdoch has collected a great variety of each class, showing that among these far-off people differentiation of structure for functional ends has been carried to a high degree of perfection. The Natural History chapters, also written by Mr. Murdoch must not be overlooked by the ethnologist, inasmuch as the life history of the people is intimately connected with the restricted fauna of this region.

Mr. Murdoch will publish in the near future a minute description of the Point Barrow Eskimo, including their arts and their customs, so far as he was able to gather facts concerning them.

It is certainly refreshing to follow a man who enters upon the work of exploration after a severe training under the elder Agassiz.—*O. T. Mason.*

THE BLOW TUBE IN THE UNITED STATES.—In all tropical countries where the cane grows the natives have become expert in the use of the blowing tube. The Indians of the Muskoki stock living in Southern Alabama, Mississippi and Louisiana have been known since the early explorations to have been expert in the use of this weapon. The Choctaws of our day take the longest and straightest cane they can find in the brake for their tube, and short pieces of split cane for their missile One end is charred and scraped to a long slender point. The other is wrapped with a little strip of rabbit skin or a wad of cotton. With these the Choctaws are still expert in shooting rabbits, birds and fishes; for the latter using a barbed or retrieving arrow. These facts have been known and stated before, but what follows has never before, to our knowledge, been published. The Shetimasha Indians, about a hundred in all, living on a small bayou south of New Orleans, use the single barreled blow-tube precisely like that of the Choctaws, but they also have combinations of tubes, as we would say, viz., five barreled, eight barreled, &c., blow-tubes. They are made as follows: A number of tubes, in our collection ranging from five to eleven, of the same length and calibre are fastened securely together like a long pan-pipe by means of splints of split cane. The arrows are of split cane and vary at the point from the slender needle form to a broad arrow form. The butt end has a wad of cotton yarn 3 inches long fastened on like the bristles of a cylindrical brush. When the hunter wishes to use this weapon he loads his five or ten barrels and, stealing upon a flock of birds, lets drive the whole set one after another in quick succession. The superiority of such an arm over a single tube is very great and it is singular that no other savages have ever studied it out.

The weapons herein described were presented to the National Museum by the Commissioners of the State of Louisiana at the New Orleans Exposition. At the same time many specimens of basketry and other handiwork made with great skill were forwarded. These also bear witness to the superior skill of the Shetimashas.

PHYSICAL EDUCATION OF CHILDREN. — Dr. E. Pokrovski, of Moscow, has published in Isvestia of the Society of Friends of Natural Sciences, Anthropology, etc., XIV, fascicle 1, 2, 3, a treatise on the physical education of children among different peoples and particularly in Russia. The contents of the treatise are given, not only to show the line of thought, but to present the analysis of a most interesting subject:

Chapter I. Attention paid to the protection and development of the embryo, heredity, relations of the sexes, condition of woman, consanguine marriages, polygamy and polyandry, marriage in classical antiquity, care taken of pregnant women among ancient and modern peoples.

Chapter II. Abortion and infanticide; motives: superstitions, fear of monsters, misery, etc., legislation relative to abortion and infanticide.

Chapter III. Parturition and the condition of the new born.

Chapter IV. Care relative to the umbilical cord.

Chapter V. Dwelling of the infant in the family of the parents.

Chapter VI. Care of the skin.

Chapter VII. Bathing of infants.

Chapter VIII. Cold baths and baptism, in Europe, in Thibet, &c.

Chapter IX. Dressing of infants among ancient peoples and modern savages.

Chapter. X. Dressing of Russian children.

Chapter XI. Enameling (emmaillotement).

Chapter XII. Kneading and rectification of the body of the infant.

Chapter XIII. Artificial deformation of the skull, ancient macrocephals, deformation among modern peoples, especially in Russia, Caucasia, Poland, Lapland, &c.

Chapter XIV. Influence of the infant's posture in its bed upon the deformation of the occiput, custom of bedding children among the Thracians, Macedonians, Germans and Belgians of the 16th century, and among the modern Asiatics. The form of the occiput in Russians of the Kourgans, from the craniological collections of Moscow.

Chapter XV. The cradle among different peoples.

Chapter XVI. The cradles of the Russians.

Chapter XVII. Cradles among other peoples of Russia, Tsiganis, Fins, Esths, Livonians, Laps, Poles, Jews, Lithuanians, Tcheremis, Bashkirs, Nogal, Sarts, Kirghiz, Kalmuks, Yakuts, Buriats, Tunguses, Solotes, Woguls, Samoides, Goldoi, Koriaks, Kamtchadals, Caucasians, etc.

Chapter XVIII. Methods of putting children in their beds, of carrying them and transporting them, dependence on climate, mode of life; bearing them on the arm, back, neck, head, hip; in bag, paniers, chests, skins, &c.; customs of the Chinese, Negroes, Hottentots, American Indians, Kamchadales, Japanese, etc., in this regard.

Chapter XIX. Amusement of the child by the mother in Russia.

Chapter XX. Accustoming the child to sit and to go on all fours.

Chapter XXI. The upright position and walking.

Chapter XXII. Importance of food.

Chapter XXIII. Suckling among various peoples, ancient and modern.

Chapter XXIV. Among the Russians.

Chapter XXV. Among other peoples of Russia.

Chapter XXVI. Ethnic mutilations of children, tattoo, depilation, piercing the nose, the ears, the lips or the cheeks; filing and removing the teeth, castration, circumcision and similar mutilations; corset, Chinese feet, high heeled boots, &c.

Chapter XXVII. Games, sports and amusements of children.

Chapter XXVIII. Treatment of the maladies of children among different peoples. Popular child medicine in Russia, Germany, England, Switzerland, Dalmatia, among the Kalmucks, Kirghiz, Caucasians, ancient Hindoos, Iranians, etc.

Chapter XXIX. Care relative to the corporeal development of children and the means employed to toughen and fortify them; seclusion of children, asceticism, horsemanship, physical and warlike training of children among savages, etc.

Chapter XXX. Role played by animals in the education of man,—cows, goats, dogs, she wolves, apes, etc.

Chapter XXXI. Physical education among the children of Russian peasants, and the results.

Chapter XXXII. Conclusions.

MICROSCOPY.[1]

OSMIC ACID AND MERKEL'S FLUID AS A MEANS OF DEVELOPING NASCENT HISTOLOGICAL DISTINCTIONS.[2]—In preparing embryological material for the microtome and the microscope, our choice of preservative fluids depends on the advantages offered in three principal directions. We inquire first of all what reagent, or combination of reagents, will best preserve the natural *form, relations* and *internal structure*. We next endeavor to ascertain which of the fluids appearing to satisfy the first point will leave the preparation in the most favorable condition for sectioning; and, finally, we have to consider the *differentiating capacity* of the fluids, and the conditions under which the highest differential effects can be obtained. This highly important quality, which belongs, in varying degree, to all hardening and staining reagents, serves two general purposes, one of which is purely histological, the other strictly embryological. In the one case, the aim is to sharpen the definition of individual elements, and to strengthen histological distinctions; in the other, the object is to demonstrate those subtle and imperceptible differences in the constitution of embryonic cells, which furnish the earliest premonitions of their histological destiny. The histologist deals with the first class of distinctions—the embryologist must deal with both. The embryologist cannot stop with the study of structure and topographical relations, as they exist in any particular stage; he is compelled to follow the entire developmental history of the cells, from their most indifferent up to their most highly specialized condition. Beginning with material more or less homogeneous in aspect, he finds it necessary to forestall development, and seeks to bring out distinctions that have not yet ripened into morpho-

[1] Edited by Dr. C. O. WHITMAN, Mus. Comp. Zool., Cambridge, Mass.

[2] Read before the American Society of Naturalists, December 30, 1885.

logical definition. In short, his task is no less than that of discovering, by chemical means, promorphological conditions, which shall reveal the destination of cells before nature has given them any definite histological stamp. The means that suffice to demonstrate fully formed tissue elements are not always identical with those required in tracing their histogenetic development. As yet we know very little about the capacity of different preservative fluids in the very important work of developing nascent histological distinctions. It is often at the expense of much time and patience that reagents are found which combine the first two qualifications we have mentioned, and the experimenter who has been so far successful too frequently flatters himself that he has reached the highest rung in the ladder of technical bliss, if his preparations admit of being "sliced like cheese or cartilage." But one requires no very large amount of knowledge of the aims, and experience in the ways and means, of embryological research, in order to understand that the investigator's art does not culminate in sections of cheese-like homogeneity. To be able, through serial sections, to lay bare each individual cell of a complicated organism is certainly a great triumph in microtomy; but such a feat may be, as it not infrequently has been, accomplished without leading to any important results, and simply because the methods of preparation have not been selected with a view to secure the needed differential effects.

Having defined a special aim in the use of embryological methods, it remains only to consider the practical side of the subject. The differential effects of most preservative fluids, when used singly, are extremely weak, and often quite inappreciable. To be of service, they must be strengthened or reinforced by some happy combination of reagents, discoverable only by experiment. Differential results are generally sought for through metallic impregnations and through various methods of staining, as double staining, multiple staining, overstaining followed by partial decoloration, etc. But I am not aware that such means alone are sufficient for the special purpose under consideration. In order to demonstrate differences, not of form, but of molecular constitution, the foundation for the desired effects must be laid in the process of hardening. Staining reagents may then serve to complete the work.

As an example of what may be accomplished in this way, I will give briefly my own experience with osmic acid and the so-called Merkel's fluid, which is a mixture in equal parts of chromic acid (¼ p. c.) and of platinum chloride (¼ p. c.). I have tested these reagents with three different classes of eggs, and have obtained important results, some of which have already been published. In the case of pelagic fish-eggs, with which my first experiments were made, the method of procedure is as follows: The eggs, with a little sea-water, are placed in a watch-glass; then, by the aid of a pipette, a quantity of osmic acid (½ p. c.) equal (as nearly as one can judge) to that of the sea-water is added. At the end of from five to ten minutes, the eggs are washed quickly in clean water, and transferred to a chrome-platinum solution, differing from Merkel's mixture only in having a higher per cent of chromic[1] acid, where they may remain from one to three days. After this treatment, the blastoderm may be easily freed from the yolk, and, after a thorough washing in clear water for a number of hours, the preparation may be passed through the usual grades of alcohol, stained and sectioned, or mounted in toto. The osmic acid fixes the natural form and structural features of the egg perfectly, and the mixture of chromic acid and platinum chloride completes the work of hardening, and at the same time removes much of the brown or black color imparted by the first reagent. I have tried various other reagents after the osmic acid, but with far less satisfactory results. Picro-sulphuric acid, instead of arresting the blackening process of the osmic acid, increases it. Simple chromic acid arrests the blackening, but does not remove it (as does Merkel's fluid), and causes considerable contraction. Müller's fluid, recommended by Henneguy, is equally unsatisfactory. By this method a very marked differentiation is generally obtained as early as the sixteen-cell stage, the four central cells showing a very light brown shade, while the twelve peripheral cells have a much deeper shade. In later stages of cleavage, the distinction between central and marginal cells becomes still stronger, so that it becomes possible to trace the entire history of the origin of the so-called parablast, over which there have been so many controversies. The very difficult question as to the precise origin of the permanent entoderm is not settled by this method.

The same reagents may be successfully applied to the eggs of Clepsine; but here the mode of procedure is somewhat different, as regards Merkel's fluid. This mixture, employed at its normal strength, is allowed to work from one to two hours only. The differential effects are here very marked, extending not only to the different germ-layers, but even to cell-groups destined to form the central nervous system, the nephridial organs, larval glands, etc. None of the methods hitherto employed with these eggs has given results at all comparable with those I have mentioned.

In the case of the frog's eggs, I allow the osmic acid from twenty to twenty-five minutes, then transfer directly to the chrome-platinum solution employed with fish-eggs (twenty-four hours). The eggs are next placed in water and freed from their gelatinous envelopes by the aid of sharp needles and a dissecting microscope. After washing in flowing water for at least two hours, the eggs may be treated with alcohol and stained accord-

[1] A one per cent solution is used in place of the normal ¼ p. c. solution.

ing to desire. My experiments with these eggs have not yet been carried very far, and I can only say that the material, so far as examined, has turned out well. If the sectioning is not delayed too long, no disagreeable effects of crumbling will be experienced. —*C. O. Whitman.*

THE FUNCTION OF THE COMPOUND EYE.—It is held by Exner, Carrière, and others that the compound eye does not distinguish the *forms*, but only the *movements* of objects. The eye would thus be merely an organ of orientation, capable of recognizing differences in the intensity of light. Plateau[1] has undertaken a series of interesting experiments designed to test the validity of this view. The method of experimentation was as follows:

A room five meters square is furnished with two windows, which face the west. The windows are provided with shutters, by means of which the room can be made dark. In each shutter a hole is cut large enough to receive a pane of ground glass. The vertical distance from the floor to the center of each glass is $1.75^{m.}$ and the horizontal distance between the centers of the two panes is $2.30^{m.}$ The amount of light admitted is regulated by means of black pasteboard diaphragms, which are fitted to slide in front of the glass. The diaphragm covering the left pane is perforated with a single hole, which is amply large to allow the insect to pass through in full flight. The size of the opening is varied by using different diaphragms. The diaphragm covering the right pane is perforated with a number of small holes, through which the insect could not pass. This diaphragm remains the same through all the experiments.

To begin with, the single opening in the left diaphragm is made 10^{cm} square, and the right diaphragm is perforated with 100 small holes, each 1^{cm} square, and separated by spaces 1^{cm} in width. The 100 holes thus represent the same surface as the large opening, but the amount of light that passes the former is considerably less than that which passes the latter. In successive experiments with different diurnal insects (Diptera, Hymenoptera, Lepidoptera, Coleoptera, &c.), the size of the hole in the left diaphragm is varied, so that the amount of light is sometimes greater, sometimes less than that of the right diaphragm.

If, under these conditions, an insect let loose at the side of the room opposite the windows, invariably flies to the large opening, then we might conclude, according to Plateau, that it distinguishes the forms of objects; but if it often makes the mistake of flying against the surface perforated with holes too small to give it passage, we may conclude that it does not distinguish form, but is guided by the intensity of the light. The experiments show that the flight is directed, in the majority of cases, towards the more intense light, and hence Plateau concludes that the

[1] Bull. de l'Acad. roy. de Belg., 3^me^ sér. t. x, No. 8, 1885.

view before stated in regard to the function of the compound eye is correct. He further announces his conviction that the simple eyes are rudimentary organs that serve no important purpose. This view rests on the fact that if the ocelli are covered with opaque black varnish, the insect guides its course in the same manner as before.

While these experiments may be said to favor the conclusion arrived at by Plateau, they do not, in my opinion, furnish decisive evidence. It would be quite within the range of possibilities, that the insect distinguished perfectly well the *forms* of both the large and small holes, without taking in the relation of its own size to that of the hole through which it sought to escape. The power to distinguish forms is not tantamount to a knowledge of relations that could only be learned by experience and reflection.

A Method of Bleaching Wings of Lepidoptera to facilitate the Study of their Venation.[1]—In the common method of destroying the scales on the wings of Lepidoptera, for the purpose of studying their venation, by means of caustic alkaline solutions, there is danger of not arresting the action at the proper moment, and consequently of destroying not only the portions which it is desirable to remove, but also the scale-supporting membrane, and even the delicate veins themselves. An application of a modification of the chlorine bleaching process, commonly used in cotton bleacheries, obviates the necessity of removing the scales, and leaves the wing perfect.

The most convenient method of applying the chlorine is as follows: The wings must first be soaked a few moments in pure alcohol in order to dissolve out the oily matter in them. If this is not done the surface of the wings acts as a repellent, and will not be moistened by an aqueous solution. When the wings have become thoroughly soaked by the alcohol they are ready to be removed to a solution of common bleaching powder. This bleaching powder is sold by druggists as "chloride of lime," but it is really a mixture of calcic hypochlorite, calcic chloride, and calcic hydrate. Ten parts of water dissolve the first two compounds, leaving nearly all the third suspended in the solution. The solution should be made with cold water, filtered, and kept in a tightly corked bottle until required for use. When the wings are transferred to this solution the bleaching commences, and in an hour or two the wings are devoid of markings, although the veins retain a light brown color. This is due to the fact that chlorine cannot quite decolorize animal matter, or any substance containing nitrogen, as it does vegetable tissue.

After the color has sufficiently disappeared from the wings they should be transferred to a wash composed of one part of

[1] G. Dimmock, Proceedings of the American Association for the Advancement of Science, Detroit meeting, August, 1875.

strong hydrochloric acid to ten parts of water. And here it may be added that in case the bleaching does not readily commence upon immersion in the bleaching solution, the action may be hastened by a previous dipping in the dilute hydrochloric acid. In the bleaching solution a crust of calcic carbonate, formed by the union of the calcic hydrate of the solution and the carbonic dioxide of the air, is deposited on the wings, and this calcic carbonate the final wash in dilute acid will remove. As soon as the calcic carbonate has disappeared, and all bubbling, consequent upon its decomposition by the hydrochloric acid, has ceased, the wings should be well soaked in pure water. They may then be secured on cards with a mucilage of gum tragacanth; or upon glass by the proper transfers, through alcohol and chloroform, to Canada balsam.

A solution of sodic hypochlorite, known as *Eau de Labarraque* or a solution of potassic hypochlorite, known as *Eau de Javelle*, when used in place of the solution of bleaching powder does not leave a deposit of calcic carbonate on the wings and thus dispense with the wash of dilute acid. A solution of zinc hypochlorite acts more delicately than a solution of sodic hypochlorite, and may be used in place of the latter, as may also solutions of aluminic hypochlorite, or magnesic hypochlorite.

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SCIENTIFIC NEWS.

— The recent meeting of the Society of Naturalists, held at Boston, December 29 and 30, will long be remembered with pleasure by those who had the good fortune to be present. The excellent plan of the founders of the society of limiting the range of the papers to the discussion of methods of teaching and research, leaves but small foothold for bores, and, indeed, the series of papers furnished an exhilarating succession of suggestive and easily grasped ideas. Most of the sessions were held in the physiological lecture-room of the new Harvard Medical School building and just adjoining the laboratory of Dr. Bowditch, which is probably unparalleled for its wealth of ingenious and effective apparatus, designed and made on the spot. The courtesies of the Harvard members of the society very agreeably occupied the hours not strictly devoted to business.

— Professor T. J. Burrill deals, in the *Botanical Gazette*, p. 334, with two mechanical effects of cold upon trees—the radial splitting of wood and bark, and the separation of bark or wood layers in a concentric way.

The first is explained by water freezing in plates parallel to the surface of an organ, and then, additions being made to the base, crystals perpendicular to the surface will be formed. Thus the wood contracting, and the ice expanding tangentially and longitudinally (chiefly the former), radial bursting is the result. The south side of a tree is the weakest, as more water exists there, and ice is first formed. Direct observation shows that the specific gravity of sap is greater on the north side of a tree.

Concentric splitting is explained by minute ice-crystals forming with their axes perpendicular to the wood-cylinder, thus causing radial tension. Want of ripeness of tissue, in the sense of the relation of water to other constituents, is the chief predisposing cause.

— Henry W. Beyerinck has, in the *Botanische Zeitung*, examined the structure of the remarkable galls produced on the internodes of the stem of *Poa nemoralis* by the attacks of *Cecidomyia poæ*. While, under normal conditions, grasses are able to produce roots only from the nodes, these galls are clothed with a thick matting of roots produced from the pericambial layer of the internodes. When first found these roots differ in no respect from ordinary underground roots, being provided with a root-cap, and a central vascular cylinder with a few pitted vessels, but with no root-hairs. In the course of development they assume more and more the character of aerial roots, and lose their root-cap.

— Count G. de Saporta enters into an elaborate reply, in the Bulletin of the Geological Society of France (XIII, p. 179), to the theory of Nathorst that the supposed organic remains of a very early geological period are in reality the petrified impressions of the footprints of animals. He maintains that a minute examination of their structure entirely contradicts this view, and that even those about which Nathorst expresses the greatest doubt may be petrifactions of algæ in half-relief.

— Dr. F. W. Goding announces for early publication Lives of eminent economic entomologists of North America, a work to consist of about 150 parts, with plates. Price, $2.00, $2.50 and $3.00. Subscriptions to be sent to the author at Ancona, Livingston county, Illinois.

— Mr. E. T. Cresson, of Philadelphia, the well-known hymenopterist, after a long interval of forced cessation from scientific work, has returned to the study of the Hymenoptera, and is preparing a synopsis of the whole order which he intends shortly to publish.

— Dr. P. R. Uher has prepared a catalogue of the Hemiptera Heteroptera of North America. It is published by the Brooklyn Entomological Society, and can be had at the price of 50 cents of Mr. John B. Smith, U. S. National Museum, Washington, D. C.

— Professor C. E. Hamlin, assistant in charge of the Mollusca of the Museum of Comparative Zoölogy at Cambridge, died January 3d. He formerly held the chair of natural history at Waterville College, Maine.

— N. Joly, a well-known French zoölogist, died October 17, at Toulouse.

— Mr. S. H. Scudder has retired from the editorial management of *Science*, which is now edited by Mr. N. D. C. Hodges.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Society of Naturalists Eastern U. S., Dec. 29–30.—This active society numbers 130 working naturalists and geologists, and was organized for the discussion of methods of investigation and instruction, laboratory technique and museum administration, and other topics of interest to investigators and teachers of natural science. Membership is restricted to those who have done original work. The meeting was held at Boston, and was certainly not inferior in interest to those previously held.

The society chose as officers for the following year: President, G. K. Gilbert, of Washington; vice-presidents, Professor E. D. Cope and Dr. Harrison Allen, of Philadelphia, and Professor George L. Goodale, of Cambridge; secretary, S. F. Clarke, of Williams College; treasurer, Charles A. Ashburner, of Philadelphia; executive committee, Professor R. Ramsay Wright, of Toronto, Dr. C. S. Minot, of Boston.

Gilbert, G. K. Opening address.
Morse, E. S. On museum cases.
Bowditch, H. P. Demonstration of vaso-motor experiments.
Bowditch, H. P. Exhibition of model of the eye.
Wilder, B. G. On the use of alinjected sheep hearts in class practicums.
Wilder, B. G. Illustrations of the advantages of alinjection, vascular and visceral, in preserving material for dissection for class practicums and for permanent preparations.
Dwight, Thomas. Modern anatomical methods.
Mixter, S. J. Exhibition of injections.
Ernst, H. C. Cultivation of micro-organisms.
Davis, W. M. Methods of observing thunderstorms and discussing the results.
Warren, J. W. Demonstration of reaction time apparatus.
Warren, J. W. A simplified demonstration of the reaction of saliva.
Wright, R. R. Improvement on rocking microtome.
Wright, R. R. Photography as an aid to natural history illustration.
Gage, S. H. Dunnington's method of making colored diagrams, with modifications.
Wilder, B. G. Exhibition of preparations illustrating certain branch and class characters.
Oliver, Chas. A. Apparatus for the investigation of the color sense.
Comstock, J. H. A new method of arranging entomological collections.
Allen, Harrison. Exhibition of photographs in illustration of animal locomotion.
Wadsworth, M. E. Laboratory instruction in mineralogy.
Kingsley, J. S. Some photographic processes of illustration.
Hyatt, A. Museology.
Crosby, W. O. Arrangement of mineralogical collections of B. S. N. H.

Davis, W. M. Geological sections illustrating rate of deposit and thickness of formations.
Whitman, C. O. Osmic acid and Merkel's fluid in embryological research.
Farlow, W. G. Teaching biology at college.
Davis, W. M. On the use of models for instruction in geology.
Minot, C. S. Some improvements in histological technique.
Goodale, G. L. Exhibition of botanical physiological apparatus.

American Philosophical Society, May 1, 1885.—Dr. H. Allen made a communication on the tarsus of bats, etc.

May 15.—Professor H. C. Lewis presented an account of the great trap-dyke across S. E. Pennsylvania.

June 19.—Dr. A. S. Gatschet presented a paper on the Bœtheek Indians, with a vocabulary. Professor Cope presented a second continuation of researches among the Batrachia of the coal regions of Ohio; also a paper by Dr. A. C. Stokes, of Newton, N. Y., on some new hypotrichous Infusoria.

July 17.—Professor D. Kirkwood, of Bloomington, Indiana, presented a communication on the comet of 1866 and the meteors of November 14.

October 2.—Dr. F. A. Genth presented contributions from the laboratory of the University of Pennsylvania, xxiv—contributions to mineralogy. Dr. D. G. Brinton presented Polysynthesis and incorporation as characteristics of American languages. Dr. F. S. Kraus (Vienna) sent in a paper entitled Aus Bosneen en Herzegovina. Professor E. D. Cope presented a catalogue of the species of Batrachia and reptiles contained in a collection made at Pebas, Upper Amazon, by Mr. Hawkwell.

Oct. 16.—Professor Cope presented for the Transactions a paper on the species of Iguanidæ; and also for the Proceedings (1) a paper on the structure and affinities of the species of fishes from the Eocene of Wyoming Territory; (2) a report on the coal deposits near Zaculatipan, Hidalgo, Mexico; (3) an account of the structure of the brain and auditory apparatus of a theromorphous reptile.

Professor Houston made a statement as to the effect of the late explosion of 285,000 pounds of dynamite at Flood Rock, Hell Gate, N. Y., stating that in his opinion earthquakes were produced by the cooling of a heated surface.

November 20.—Dr. Brinton presented a paper on the Mangue language.

Professor Cope sent in a 13th contribution to the herpetology of tropical America.

Professor Houston sent a communication upon photography in a lightning flash during the storm of October 29, 1885, and exhibited the negatives and photographs.

Dr. Frazer presented a résumé of the proceedings of the recent International Congress of Geologists at Berlin, which he had attended as a delegate from the American Association for the Advancement of Science, with other American scientists. Dr. Frazer exhibited a device for printing boundary lines automatically; also a track chart of the North Atlantic. Dr. Frazer also drew attention to the Geological and Geographical Dictionary of Sig. Villanova, of Pisa.

December 4.—Dr. Frazer presented a résumé of the geology of York county, Pa.

Professor Cope read a paper on the physical conditions of memory.

BIOLOGICAL SOCIETY OF WASHINGTON, Nov. 14.—Communications: Mr. Richard Rathbun, Remarks on the Wood's Holl station of the U. S. Fish Commission; Dr. W. S. Barnard, Specimen-mounting case and method; Mr. John A. Ryder, A new and practical system of raising oysters on a large scale; Mr. Frederick True, On a spotted dolphin apparently identical with the *Prodelphinus doris* of Gray.

Nov. 28.—Communications: Dr. Theobald Smith, A simple device for storing cover-glass preparations illustrative of bacterial disease; Dr. W. S. Barnard, 1. Environmental digestion; 2. Specimen mount: tube-holders, labels and stoppers; Dr. C. Hart Merriam, The work of the U. S. Department of Agriculture in economic ornithology; Mr. Charles D. Walcott, Evidence of the loss of vital force in certain trilobites on approaching extinction; Mr. Frederick True, A new study of the American pocket rats; genus Dipodomys.

Dec. 26.—Dr. C.Hart Merriam, Contributions to North American mammalogy. 1. The genus Tamias; Mr. F. H. Knowlton, Multiplication in the Gynœcium of *Datura stramonium* L.; Professor O. T. Mason, Mutilations of the human body.

AMERICAN ORNITHOLOGIST UNION.—The annual meeting took place at the American Museum of Natural History, in New York. The session opened on Tuesday, Nov. 17, and lasted two days. Among the members present were Messrs. J. A. Allen, R. Ridgway, W. Brewster, W. W. Cooke, O. Widmann, Dr. C. H. Merriam, A. K. Fisher, H. A. Purdie, and E. P. Bicknell. A number of papers of very great interest were read, and there was much discussion of knotty points in ornithology. One of the most interesting features of the meeting was the account by Mr. Brewster of his observations carried on at lighthouses during the season of migration. By means of these observations the speaker had penetrated deeper into some of the secrets in the life of the small night-migrating birds than any one else has yet done. His account of what he saw was most entertaining and valuable, and opens a new chapter in the history of our birds. The next annual meeting will be held in Washington, D. C.

LINNÆAN SOCIETY, Lancaster, Pa., Nov. 28.—Dr. S. S. Rathvon read a highly interesting paper on the Hessian fly and allied insects. Dr. J. H. Dubbs read a paper on arrows and arrow makers. The paper was accompanied by a letter from A. F. Berlin, of Allentown, Pa., and illustrated by specimens of darts and arrow heads in stone made by Mr. Berlin by the process described in the letter. Dr. T. C. Porter stated that the Lancaster county herbarium of the society needed arranging, and that the plants should be poisoned in order to preserve them from destruction by the museum pest. He offered to defray the expense incident thereto, if the members would do the actual working part of the undertaking. The doctor's generous offer was accepted, and Professor J. S. Stahr, C. A. Heinitsh, and Mrs Zell, were appointed a committee to arrange and poison the specimens in the herbarium.

Clubs.

Appalachian Mountain Club, Dec. 11, 1885.—Geodetic Observations from Moosilauke and Mansfield, Prof. E. C. Pickering; The tripyramid slides of 1885, written by Rev. Alford A. Butler, and Notes on the region east of Wild river and south of the Androscoggin, written by Mr. A. L. Goodrich.

Oct. 14.—Professor Gaetano Lanza, An ascent of Mount Garfield; M. V. B. Knox, Ph.D., Notes on the slide at Jefferson; Professor C. E. Fay, Was Chocorua the original Pigwacket?

Nov. 11.—Professor William M. Davis on mountain meteorology. The following papers by Mr. E. B. Cook, were read: Round mountain; An excursion over Mounts Nancy, Anderson and Lowell.

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The American

ERRATUM.

The word *of* at the middle of the last line on p. 26, January number, should be stricken out and the phrase should read:

* * * that in those species which fly most, these muscles would be relatively larger than in those of less power of flight.

Instead of:

* * * that in those species which fly most of these muscles would be, etc.

...and Susanna 233

...ECIES OF THE COMMON ... Hart Merriam 236

...D TRA... IN THE TRIASSIC ROCKS ..., N. ... Illustrated.] L. P. Grat- 243

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...URE.

...ky Mountain Botany.—The Catalogue ...e British Museum.—Hartman's An- ...[Illustrated].—Kane's Hand-book of ...flies.—Langille's Our Birds and their ...Living World.—Thompson's Bibliog- ...on, etc.—Recent Books and Pamph- 254

...nd *Travels.*—General.—Arctic Re- ... The Resources of Africa; Lieut. ...pedition; African News. — Asia: ... Asiatic News 261

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...rus Pilze, Century iv.—Botanical News. . . . . . .

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Microscopy.—Natural Injection.—Methods of Injecting Annelids. — An Injection-mass to be used Cold.—Method of Killing Gephyrea —A Macerating Mixture.—Haller's Macerating Fluid 313

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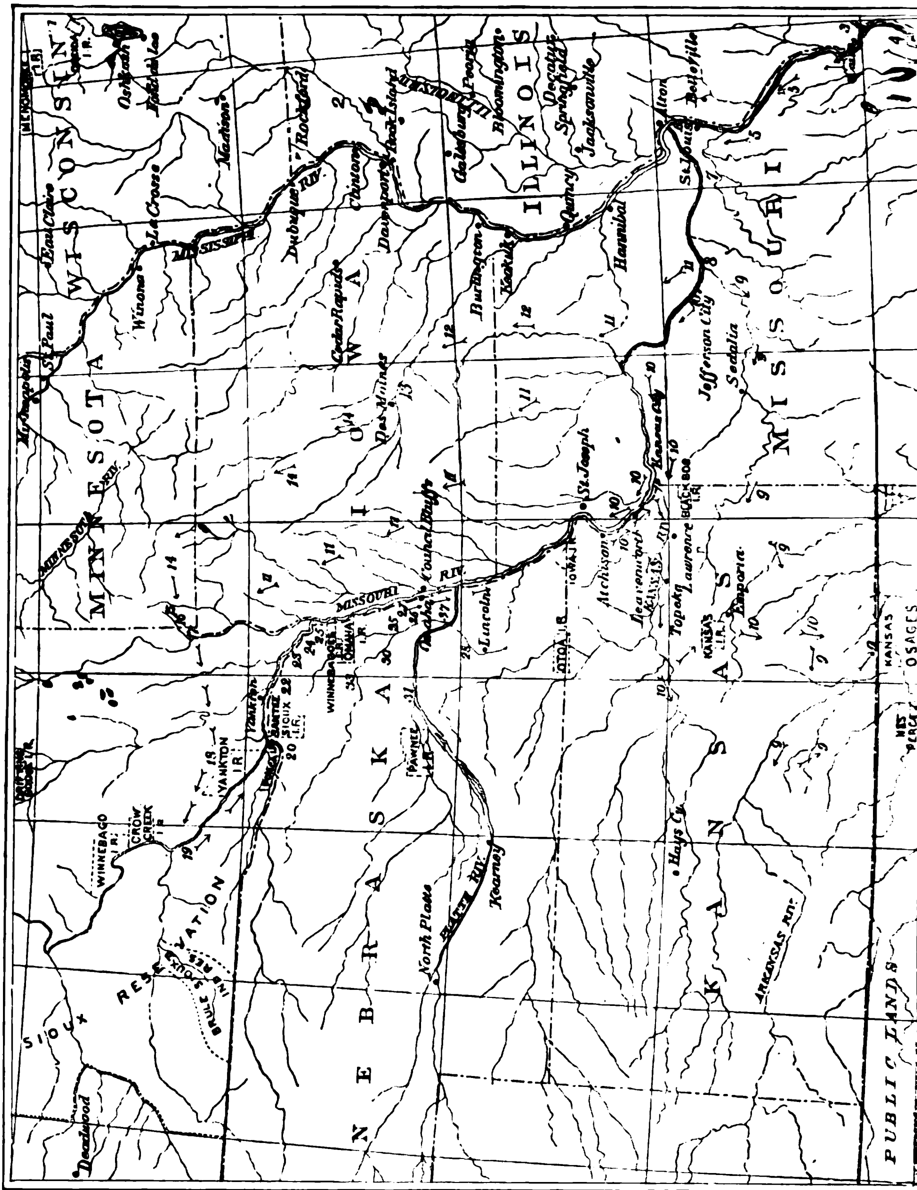
...& TAVELY...

PLATE X. MAP I.



LEGEND.—1, Winnebago habitat; 2, Iowa habitat; 3, Arkansa habitat; 4, Kwapa habitat after leaving the Omahas, etc.; 5, Omaha habitat and route after separating from the Kwapas; 6, habitat at the mouth of the Missouri; 7, course along the river; 8, habitat at mouth of Osage river; 9, course of Osages; 10, course of Kansas; 11, do. of Ponkas and Omahas (Two Crows); 12, do. of do. (according to others); 13, meeting of Iowas, Ponkas and Omahas; 14, course of the three tribes; 15, Pipestone quarry; 16, cliffs about one hundred feet high on each bank; 17, fort built by the three tribes; 18, Lake Andes; 19, mouth of White river; 20, mouth of Niobrara river; 22, Bow creek (Omaha village); 23, Ionia creek (Iowa village); 24, ⊥i-ȷañ-ga-jiñga; 25, Large village; 26, village at Bell creek; 27, course of the Iowas; 28, Omaha habitat on Salt river; 30, Ane nat'ai dha^{n}; 31, ⊥aɔnañguji (Shell creek); 33, village on Elkhorn creek; 35, village on Logan creek; 37, village at Bellevue.

THE

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MIGRATIONS OF SIOUAN TRIBES.[1]

BY REV. J. OWEN DORSEY.

"SIOUAN" is the term adopted by the Bureau of Ethnology instead of "Dakotan," as the name of the linguistic family of which the Sioux or Dakotas have been regarded as the leading nation.

The tribes whose migrations are described in this paper are the Ponkas, Omahas, Osages, Kansas, Kwapas, Iowas, Otos, Missouris, Winnebagos and Mandans. The other tribes of this family are the Sioux, Assiniboins, Hidatsas, Crows and Tutelos.

Some authors speak of a series of migrations of these tribes from the west toward the east, but the writer has not been able to learn on what authority such statements have been made, nor has he ever found any tradition of such eastward migrations among the tribes that he has visited.

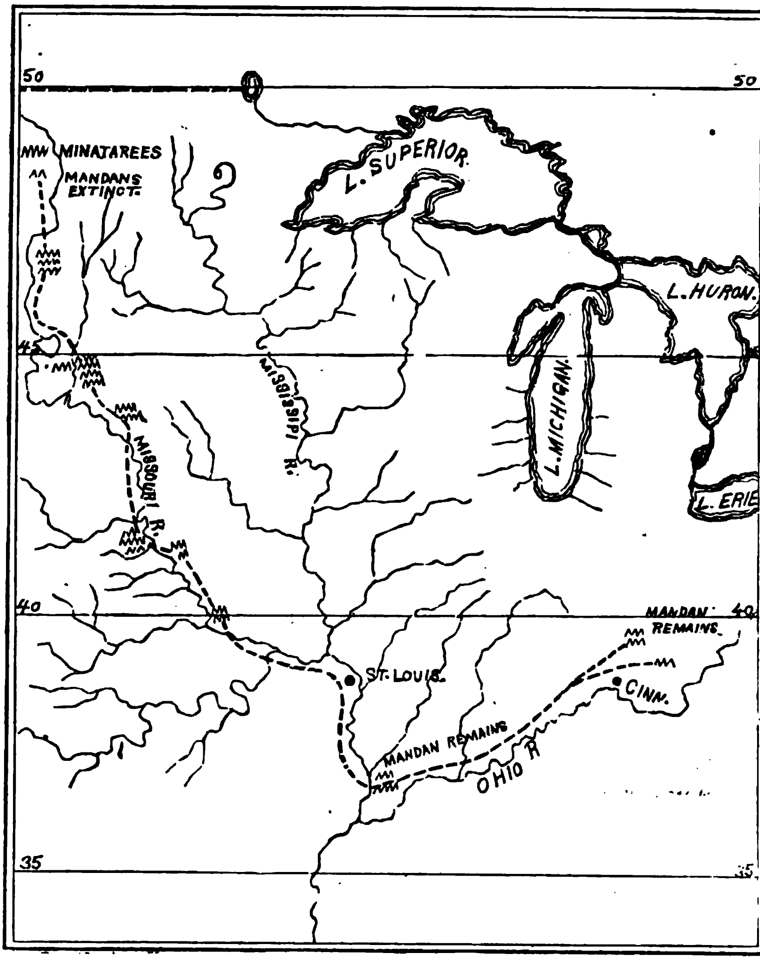
Whatever may be the value of Catlin's map of the Mandan migrations, there can be no doubt that the Mandans belong to the Siouan family. Their language shows unmistakable resemblances to the Winnebago, as well as to the Dakota, Osage, Kansas, etc. The Mandan tradition, as given to Catlin, placed the ancestors of that people east of the Mississippi river at an early day (Catlin's N. A. Indians, II, 259).[2]

The Jesuit Relation of 1640 speaks of the Dakotas and Assiniboins, placing them in the neighborhood of the Winnebagos. This last nation was probably in the region of Green bay in 1614,

[1] Read before the Anthropological Society, Washington, D. C., in 1884.
[2] See map 2.

when Champlain met eight of their men. They are also mentioned in 1620. In 1680 Father Membré said that they were near the Kickapoos. In 1766 Carver found them about thirty-five miles from Green bay.

MAP 2.



Part of Catlin's map, showing the course of the Mandans.

About three years ago the Iowa chiefs who visited Washington at that time told the writer that their people, the Otos, Missouris, Omahas and Ponkas once formed part of the Winnebago nation. In confirmation of this note are the following statements: (*a*) About the year 1848 Rev. Wm. Hamilton, missionary to the

Iowas, learned that when they sung their mystic songs they used the Winnebago language. (*b*) A careful study of the languages of the Iowas, Otos and Winnebagos shows that they are very closely related; indeed, time may prove the necessity of including them in one group instead of two. (*c*) We have the tradition given by the Prince of Nieu Wied on p. 645 of his first volume (German edition). (*d*) Gallatin (Trans. Amer. Antiq. Soc., 1836, p. 127) says that the Iowas, Otos, Missouris, Omahas and Ponkas have a tradition that, at a distant epoch, they, together with the Winnebagos, came from the north; that the Winnebagos stopped on the banks of Lake Michigan while the rest, continuing their course southerly, crossed the Mississippi river and occupied the places in which they were found by the Europeans. (*e*) There is a statement made in Maj. Long's account of his expedition to the Rocky mountains, 1819 (ed. by James), of which the substance is now given: "The parent nation originally resided somewhere north of the great lakes. On moving southward a large body seceded, staying on the shore of a lake; these became the Ho-chan-ga-ra or Winnebagos. Another band separated from the main body on reaching the Mississippi—these became the Iowas (Pa-kho-che). At the mouth of the Missouri another band stopped and made a village, hence their name, "Ne-o-ta-che" (Ni-u-t'a-chi), now called Missouris. The Otos (Wa-to-ta, lovers of sexual pleasure) left the nation on the Mississippi (according to another account they seceded from the Missouris at the mouth of the Missouri river) and went across the country till they struck the Missouri near the mouth of the Great Nemaha. Here they remained a long time. Thence they went up to the Platte, and after hunting for some time near its mouth they moved further up the Missouri and built a village on the right bank of that river, about fourteen miles below Council Bluffs, Ia. While they were there a band of Iowas established themselves on the bank of the river, nearly opposite to them and within thirty miles of the site of the Omaha village, in 1819. The Otos subsequently removed to the Platte, about twenty miles above the village occupied by them in 1819, but finding the latter situation a better one, they established themselves there (about A. D. 1769)."

"The Iowas, after remaining in a village on the Lower Missouri for a long time, were rejoined by the band above mentioned, when they returned to the Mississippi and erected a village on the Moyene," This must refer to a late period in the history of the Iowas, extending back, perhaps, not further than 1740 or 1750. This will appear the more plainly after comparing the above statement respecting the Otos with the map of the migrations of the Iowas given as Plate xxx in Vol. III of Schoolcraft's Archives of Aboriginal Knowledge. A copy of the map accompanies this article. The supposition of the writer is also in accordance with what follows about the migrations of the Iowas in company with the Omahas and Ponkas.

"The Missouris in course of time abandoned their village at the mouth of the Missouri, and gradually ascending the river at length built a town on the left bank, near the mouth of Grand river. They were found there by the French, who built a fort on an island in the Missouri, very near them, about the beginning of the last century. * * * The Missouris continued to dwell in the same locality until, about twenty years since (A. D. 1798, 1799 or 1800), they were conquered and dispersed by a combination of the Saks, Foxes and some other Indians. Five or six lodges joined the Osages, two or three took refuge with the Kansas, and the chief part of the remainder amalgamated with the Otos."

In 1673 the Otos were placed by Marquette[1] between 40° and 41° N. lat., west of the Missouri and Mississippi rivers, east of the Maha (Omahas) and south-east of the Pana (Ponkas ?). The Iowas, according to the same authority, were between 40° and 41° N. lat., north-west of the Maha and west of the Pana. In 1680 the Ainoves (Iowas) were east of the Mississippi and near the Kickapoos, according to Membré (see Shea's Discov. and Expl. Miss. Valley, p. 150). The Otos were "one hundred and thirty leagues from the Illinois, almost opposite the mouth of the Miskoncing." In 1687 the Otos were on the Osage river. In 1700 Iberville said that the Otos and Iowas were with the Omahas between the Missouri and Mississippi rivers, about a hundred leagues from the Illinois. In 1721 the Iowas were east of the Missouri river, above the Otos and below the Pawnees, being allies and neighbors of the Dakotas. The Otos were below the Iowas and above the Kansas, on the west side of the Missouri (Charlevoix, Histor. Journal, p. 294).

The Ponkas told Rev. A. L. Riggs that their ancestors used to dwell east of the Mississippi. They subsequently inhabited the

[1] See his autograph map in Shea's Discov. and Explor. of the Miss. Valley. 8vo, p. 268. N. Y., 1852.

country on the north side of the Missouri river, near its mouth. The Kansas and the Osages were the first to depart; then the Omahas and Ponkas followed the course of the Missouri towards its head. Mr. Riggs also says that the Ponkas went to the region of the Black hills, and were there before the Crows; but the Ponkas told the writer that the Crows inhabited that country and were owners of the Black hills when their ancestors arrived there, at which time there were no Dakotas in that region. This last statement is confirmed by the Dakota winter-counts in Dr. Corbusier's collection. The writer was also told that the Ponkas used to dwell north-east of the old Ponka reservation (which is in Todd county, Neb.), in a land where they wore snow-shoes. Since 1879 the writer has gained more definite information from other Ponkas, as well as from Omahas, Osages and Kansas, and it is now given.

Ages ago the ancestors of the Omahas, Ponkas, Osages, Kansas, Kwapas, Winnebagos, Pawnee Loups (Skidi) and Rees, dwelt east of the Mississippi. They were not all in one region, but they were allies, and their general course was westward. They drove other tribes before them. Five of these peoples, the Omahas, Ponkas, Osages, Kansas and Kwapas, were then together as one nation. They were called Arkansa or Alkansa by the Illinois tribes, and they dwelt near the Ohio river. At the mouth of the Ohio a separation occurred. Some went down the Mississippi, hence arose their name, "U-ga′-qpa (Oo-ga-khpa)" or Kwapa (Quapaw), meaning "the down-stream people." This was prior to 1540, when De Soto met the Kwapas, who were then a distinct tribe.

The rest of the Arkansas ascended the river, taking the name of U-ma^{n}′-ha^{n} (Omaha), "those going against the wind or current."

These names—Kwapa and Omaha—are of more recent origin than Kansas, Osage and Ponka. We find proofs of the antiquity of these three names in the names of gentes in these tribes. Thus among the Ponkas there is a Ponka gens (the Ma-ka^{n}), and an Osage gens (the Wa-ja-je). The Omahas have a Kansas gens (the ӽa^{n}-ze). The Kansas have a Ponka gens (Cedar people), an Osage gens (Deer people), and a Kansas gens (ӽa^{n}-ze, associated, as among the Omahas, with the winds). The Osages have a Kansas gens (Ka^{n}-se) and seven Osage (Wa-ɔa-ɔe) gentes, one of which is the Ponka (Pa^n-Hka). The last is associated with the red cedar. If the true meanings of the three names have been preserved, they can be gained only in one way—by questioning members of the secret societies in the tribes.

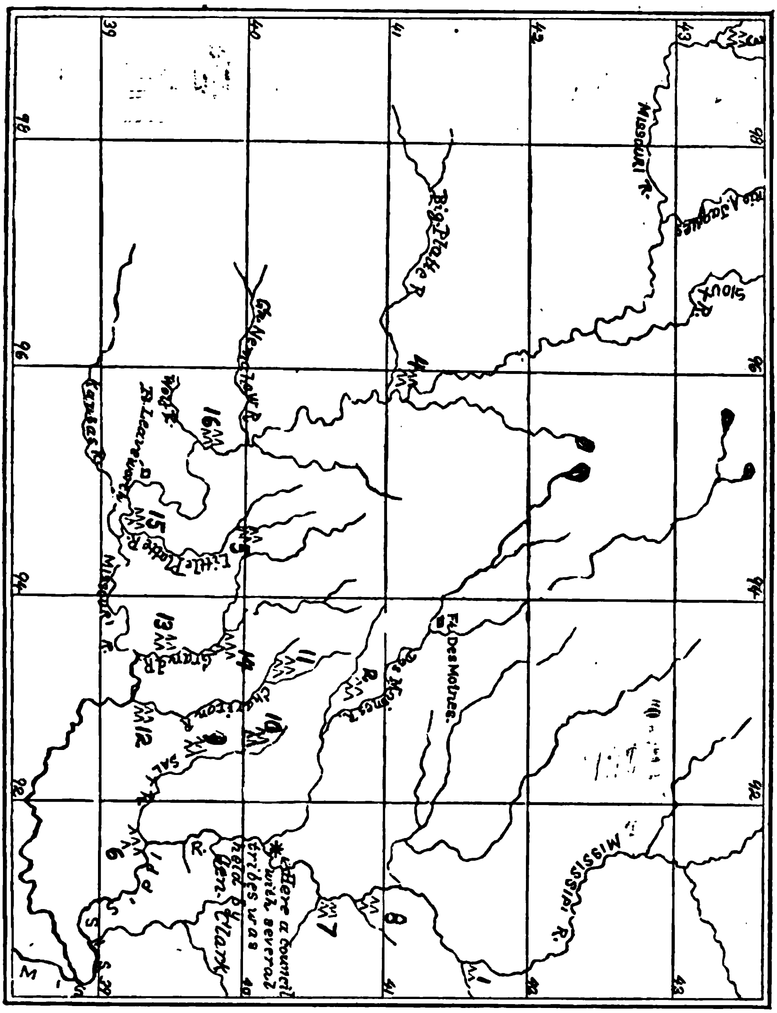
The writer has been unable to find an Omaha gens, and the only Kwapa village (not a gens) is among the Kwapas.

Joutel names four Kwapa villages—Otsote, Thoriman, Tonginga and Cappa. The first village is called by other French writers, Otsotchave, or Otsotchoue, the third, Topinga (evidently a printer's error), and the fourth, Kapaha. According to Shea these divisions of the Arkansas are extinct, but the writer has been able to find members of them still existing. When he was at the Osage agency, Indian Terr., in 1883, he met three Kwapas. From two of them he gained the following: The first village is U-ga′-qpa-qti, real Kwapas (Cappa or Kapaha). The second is U-zu′-ti-u′-hi (Otsote), which may mean village along an *usu* or lowland level containing trees here and there. The third is Ti′-u-a′-d^{dh}i-ma$^{n\prime}$ (Thoriman). The name of the fourth village could not be learned from the Kwapas; but Margry tells us that it meant "small village" in the Kwapa dialect. The writer finds that this would be expressed by Ta$^{n\prime}$-ma^n ji′-gă, with which compare Tonginga and Topinga. In July, 1687, according to Joutel, two of these villages were on the Arkansas river, and the others were on the Mississippi. A visit to the Kwapas might furnish the writer with their traditions, etc. Though they must have separated from the Ponkas more than three hundred years ago, the dialects are still so similar that the Kwapas met by the writer could understand him very easily when he spoke to them in Ponka.

The Omahas and their associates followed the course of the Mississippi till they reached the mouth of the Missouri, remaining for some time near the site of the present city of St. Louis. Then they ascended the Missouri to a place called Tce-dūñ′-ga a′-ja-be and Ma$^{n\prime}$da-qpa′-yĕ by the Kansas, and Ma$^{n\prime}$-ɟa-qpa′-dhĕ by the Osages. This was an extensive peninsula on the river, having a high mountain as a landmark.[1]

[1] The writer was told by an Osage that Ma^n-ɟaqpadhĕ was at Fire Prairie, Missouri, where the first treaty with the Osages was made by the United States. But that place is on a creek of the same name which empties into the Missouri river on the south, in T. 50 N., R. 28 W., at the town of Napoleon, Jackson county, Mo. This could not have been the original Ma^n-ɟaqpadhĕ. Several local names have been duplicated

MAP 3.



Map of the country formerly occupied by the Ioway tribe of Indians, from a map made by Waw-non-qwe-skoon-a, an Ioway brave. Drawn by Capt. S. Eastman, U.S.A. (Plate XXX, Vol. III, p. 256, Archives of Aboriginal Knowledge, by H. R. Schoolcraft. No. 3, according to the Iowa Indian, was near the great Pipestone quarry. The real place of the quarry was further east, at No. 15, of Map I. It is very probable, that No. 3 of Map 3 was near the White river, Dakota, and if so, it may have been the same as No. 19 of Map I.

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by the Kansas during their wanderings, and there are traces of similar duplications among the Osages. Besides this the Omahas and Ponkas never accompanied the Kansas and Osages beyond the mouth of the Osage river, and the Kansas did not reach the vicinity of Napoleon for some time after the separation at the mouth of the Osage river.

Here, according to the Kansas and Osages, the ancestors of the four tribes dwelt together. In the course of time they ascended the Missouri and established themselves at the mouth of the Osage river. The Iowas were near them; but the Omahas say that at that period they did not know the Otos and Missouris. At the mouth of the Osage river the final separation occurred. The Omahas and Ponkas crossed the Missouri, resuming their wanderings. The Osages ascended the stream bearing their name, and at a tributary, called by them "Tse′-ɿüⁿ-ɣa′-qa," they divided into the ɖa-he′-ɿsi (those who camped at the top of the mountain), incorrectly styled Great Osages, and the Ü-ɿsĕн′-ta (those who camped at the base of the mountain), popularly called Little Osages. The Kansas ascended the Missouri on the south side till they reached the Kansas river. A brief halt was made, and the journey was resumed. They ascended the Missouri on the east side till they reached the present northern boundary of the State of Kansas. There they were attacked by the Cheyennes, and were compelled to retrace their steps. They settled again at the mouth of the Kansas, till the "Big Knives" came with gifts and induced them to go further west. Their subsequent history, as given to the writer by two chiefs, contains an account of about twenty villages along the Kansas river, then the settlement at Council Grove, Kas., and finally the removal to their reservation in Indian Terr.

Let us return to the Omahas and Ponkas. After crossing the Missouri they were joined by the Iowas, according to Two Crows and Joseph La Flèche, of the Omahas. They said that this addition to the party was made about the time of the separation from the Osages and Kansas. But the Iowa tradition, as given to Mr. Hamilton (see map of the Iowa brave) places the first village of that tribe west of the Mississippi, on the Des Moines river. The two Omahas just named said that their fathers followed the tributaries of the Missouri till they reached the great Pipestone quarry in Minnesota. Other Omahas have said that the course was up the Des Moines river, which would naturally bring the wanderers near the quarry. The writer is inclined to believe that they ascended the Chariton river, and when at its source they would be near the Des Moines. As the Iowas were a cognate tribe, it was reasonable for them to unite with the others. At all events the traditions agree in this: the people built earth lodges (permanent villages), they farmed and hunted the buffalo and other animals. When the game became scarce in their neighborhood, they abandoned their villages and went north-west. On reaching a place near the new haunts of the game, other permanent villages were built and they were occupied for years. So they lived till they reached the Pipestone quarry (which is not given in the right place on the Iowa map). When they arrived at the Big Sioux river they built a fort. At that time the Yankton Dakotas dwelt in a forest region of Minnesota, near the Mississippi, and were called "Ja^n′-a-ʇa ni′-ka-ci^n′-ga, people (dwelling) in the woods." By and by the Dakotas made war on the Omahas and their allies, defeating them and killing about a thousand warriors. This obliged the three tribes to abandon their habitat. They fled south-west till they reached the lake where the Omahas and Ponkas obtained their sacred pole. This is now called Lake Andes, and it is at the head of Choteau creek, Dakota. There the sacred pipes were given, according to the Omaha and Ponka traditions, and the present gentes were constituted. From this place they ascended the Missouri river till they reached White river (Ni-u′-ga-cu′-de). There the Iowas and Omahas remained, but the Ponkas crossed the Missouri near the mouth of the White river, and went on to the Little Missouri river and the country near the Black hills. They subsequently rejoined their allies and all descended the Missouri on its right bank. When they reached the mouth of the Niobrara river the final separation was made. The Ponkas remained there. The Omahas settled on Bow creek, Neb., which they called "Village stream." The Iowas advanced to the stream on which is situated the town of Ionia, Dixon county, Neb., hence its name, "where the Iowas farmed." By and by the Omahas removed to a place near Covington, Neb., which is opposite Sioux City (see 24 on Map 1). The remains of this village are known as Ʇi ʇañ-ga jiñ-ga, and the lake near by is called "Dhix-u-cpa^n-u-gdhe," because of the willows along its banks.

In the course of time the Iowas passed the Omahas again and made a village near the place where Florence, Neb., now stands. After that they continued southward till they reached their reservation at the Nebraska and Kansas line. The Otos were first met by the Omahas, according to Mr. La Flèche, in comparatively recent times on the Platte river.

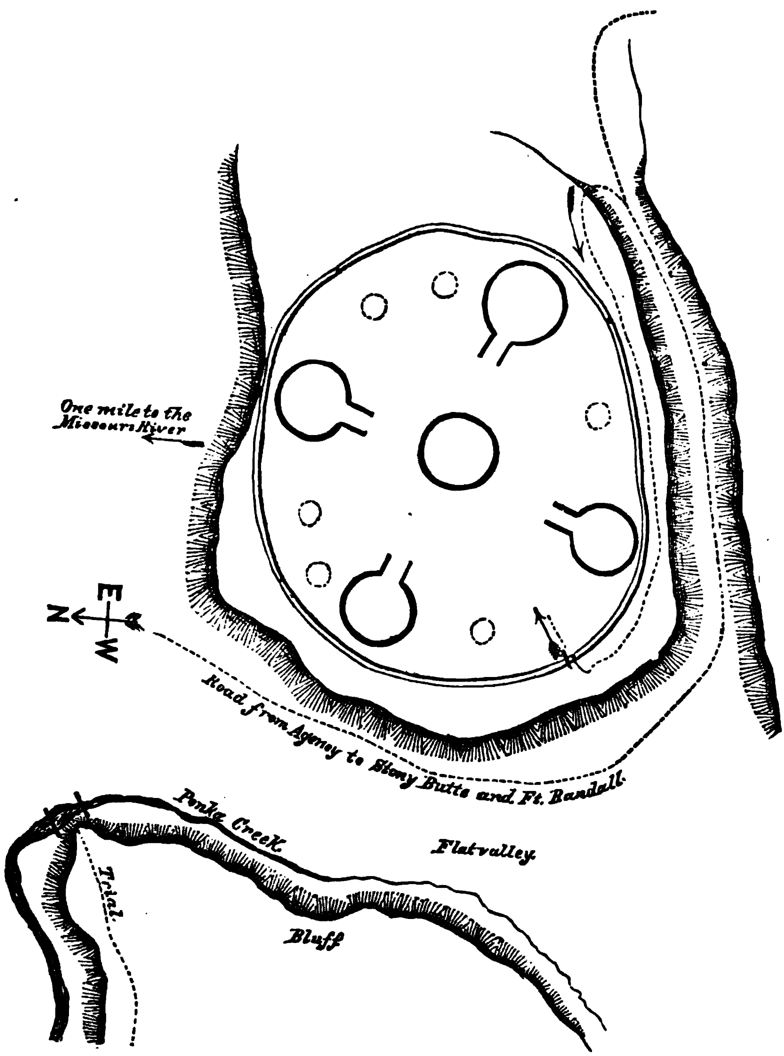
Subsequent Migrations of the Omahas.—After leaving Ʇi ɟañga jiñga (No. 24), where the lodges were made of wood, they dwelt at Zande buɟa. This is south-east of Ʇi ɟañga jiñga, and is the name of a stream as well as of a prominent bluff near by. This stream empties into Omaha creek near the town of Homer, Neb. After a great freshet the Omahas crossed Omaha creek and made a village at or near Omadi, which was called *Large village*, near *Village stream* (Omaha creek). See No. 25 on Map 1. This was a favorite resort, as we shall see. Thence they removed to Bell creek, on the west side of which they made a village (No. 26). Thence they went south to Salt creek, below Lincoln (No. 28). Thence they returned to *Large village* (No. 25). When they were there, Half-a-day, the aged historian of the tribe, was born. This was about A. D. 1800. Thence they removed to A-ne na-t'ai dha^n, *where the people perished in a prairie fire*, a hill on the Elkhorn river (No. 30). They stayed there five years. Then they settled on Shell creek, which they called Tacnañguji (No. 31). After which they returned to *Large village* (No. 25). Leaving this again, they made a village on the Elkhorn, near Wisner (No. 33), about A. D. 1822–3. Half-a-day married when he was there. About A. D. 1832–3 they returned to *Large village* (No. 25). Joseph La Flèche remembers having been there at that time. About A. D. 1841 they removed to Ta^n-wa^n jiñga dha^n, the Small village (No. 35), at the mouth of Logan creek, where they dwelt for two years. In 1843 they returned to Large village (No. 25), and in 1845 they made a village on the curvilinear top of a plateau, near Bellevue (No. 37). In 1855 they removed to their present reservation.

The Ponkas did not occupy their new country unmolested. They had some fights with the Cheyennes and Comanches. These foes dwelt near a great lake in a sandy region (ȡi-za′-ba-he-he′) near the head of the Elkhorn river, Neb. At this time the combatants used wooden darts instead of bows and arrows. The writer was at the old Ponka reservation, Todd county, Neb., from May, 1871, to Aug., 1873. During this period he often visited the remains of an ancient Ponka fort not more than a quarter of a mile from his house. A rough diagram of this fort is given.

After the Iowas and Omahas went south the Ponkas claimed all the northern part of Nebraska, along the Missouri river, as far as what is now Dakota county, where began the Omaha territory.

The Ponkas say that they had seven "old men" since they became a separate tribe. Under the fifth "old man" they first saw the pale-faces. They are now under the seventh "old man."

MAP 4.



Map showing the Ponka fort.

The Omahas, according to some men of their tribe, are now under their fifth "old man." Among the Dakotas, according to some anthorities, an "old man" denotes a cycle of seventy years or more. If the Ponkas use the term in this sense, and are correct in so doing, they may have had a tribal existence for about 490 or 500 years. This would extend back as far as A. D. 1390 or 1380. (It was told the writer in 1880.) Let us see how this agrees with the reports of early writers taken in connection with the period required for the migrations which have been described. We must remember that in those days firearms were unknown, and that therefore the destruction of game was not as rapid as it now is; that horses could not be had, rendering locomotion very slow; that removals from permanent villages (such removals depending on the destruction and departure of game) need not have been at very short intervals, especially when the construction of of such villages was a work of great labor, owing to the primitive character of the tools employed, and has a religious significance, being accompanied with sundry mystic rites, some of which are still preserved among the Osages and Kansas.

The director of the Bureau of Ethnology found a tradition among some of the civilized tribes in the Indian Territory, refering to the ancestors of the Kwapas, etc., which agrees with what has been said, *i. e.*, that they dwelt east of the Mississippi prior to A. D. 1700. In 1673 Marquette had heard of the Maha (Omahas), Pana (Ponkas ?), Pahoutet (Iowas, Paqotce) and Otontantas (Otos). as inhabiting the country on the right bank of the Missouri river. The separation of the Iowas, Omahas and Ponkas, and therefore all previous migrations, must have occurred before 1673. Furthermore, the separation of the Kwapas from the others, and the taking of these correlative names, Kwapa and Omaha, must have occurred prior to A. D. 1540, as De Soto met the Kwapas in that year.

Even at the present day, when horses have been available, the Omahas have remained in a permanent village for ten years at a time, and have returned repeatedly to such an old village. We have no recorded tradition of similar returns to favorite villages in prehistoric times, yet such returns may have occurred, and if known would tend to increase the duration of the period between the meeting of the white men and the time when the Indians in question were east of the Mississippi river.

THE TORTURE OF THE FISH-HAWK.

BY I. LANCASTER.

WHILE engaged in the task of explaining the mystery of the flight of soaring birds on the shores of the Gulf of Mexico, where many species abounded, unusual and astonishing performances were witnessed on the part of these inhabitants of the air.

The month of March revealed more of these out-of-the-way feats than other times of the year, and as the breeding season occurred in this month, especially on those remote keys and interminable flats constituting the peninsula of Southern Florida, it was fair to presume that feelings growing out of the relations of the sexes prompted the remarkable behavior.

Were it not absurd to transfer to external nature those moral emotions generated in the mind from the primordial impressions of pleasure and pain, one would be tempted to assert a radical diabolism in the scheme of things on witnessing the seeming fiendishness of some of these creatures having dominion of the air. Nothing but a free application of the doctrine of the transmission of qualities through inheritance, coupled with variations amounting to divergence, as the line descends, can dispose of deliberately evil intention somewhere, or of a natural process, the outcome of which is bad. No inference from the hooked beak and grasping talons of the carnivorous birds gives a clue to the origin and development of a disposition on their part to inflict pain for the mere sake of the torture. Those structures find their function in the legitimate life struggle, but the infliction of needless pain, in no way connected with that conflict, seems to be imposed from another source.

The distribution of land and water on the Gulf coast of Florida is favorable to the existence of fish. The interminable flats, bare, or covered with a thin sheet of water at low tide, and traversed by many winding channels, give the smaller kinds refuge from the rapacity of the larger, and furnish breeding grounds without stint. The many tidal creeks, often a succession of deep holes connected by mere rivulets, through which the tide sluggishly ebbs and flows, also give security for the deposit of eggs and growth of young. The gulf is also a vast caldron of warm water, prolific through its whole extent in monsters of the deep, many of which, such as sharks and porpoises, penetrate the passes between the keys and entering the channels of the bays play havoc with the lesser tribes. These are devoured in great quantities, and the killed and wounded which escape the maw of their fierce enemy can be seen stranded on the flats at low tide.

All this teeming life goes on in a climate of surpassing loveliness. Frost is a rarity; ice unknown; day succeeding day of delightful blandness. Extreme heat is not experienced, and storms worthy of the name very rare. The soil of the lower peninsula is pure sand as sterile as Sahara. The vegetation is prolific in air plants, semi-tropical bushes and stunted growths, and a perpetual verdure is everywhere. But there is nothing in it all that a man can live on, and hence the population is limited to the sporadic migrations of excursionists and invalids, and a few "crackers," always hungry, and seeking something capable of being devoured.

This combination of circumstances forms a splendid environment for such birds as can in any way subsist on a fish diet, and what might be expected is what is found. Birds with legs long enough to wade on the flats; those which have inherited the expertness of a swimming-school adept and can dive with ability, and those which can subsist on the carcases of unfortunates, have here everything pretty much to suit them. Long lines of pelicans can be seen on every hand, with that grandmotherly air of supreme contentment arising from a continuously satisfactory cuisine. Cranes of all lengths of legs and necks, stalk about, hastily gobbling their prey. The carrion-eating vultures are always present enjoying the incoming breeze by resting in it on motionless wings, or wheeling about on the lookout for subsistence.

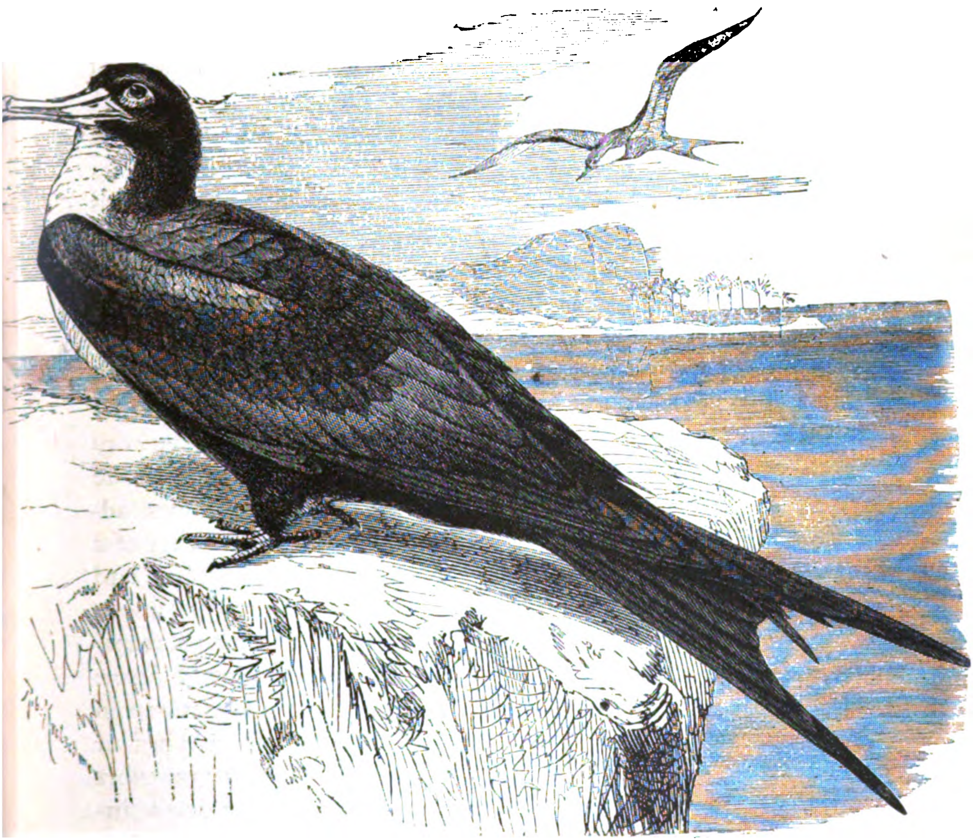
But the birds which particularly interest us are the fish-hawks, also dependent, like the others, on the life found in the tepid waters. These birds are arboreal in their habits, nesting in the tops of the pine trees and rarely resting on the ground. They fish for the most part in the creeks and secluded inlets, hovering over the waters and suddenly capturing their victim by diving upon it. But they sometimes come over the open waters of the bays, and when the keys are covered with trees, over the gulf, to find their food. On first acquaintance their actions seemed inexplicable. I could not account for their eccentric ways. While in the hidden places of the creeks they utter no cry, and seem to be efficient masters of the craft, but in the open they vacillate painfully.

They are large, active-winged birds, never soaring, are quite strong, and weigh about six or seven pounds. On leaving the trees lining the shore, perhaps allured by a school of mullet in the channel, they seem eager for action, and all alive with expectation, but just before stooping on the fish would set up a frightened, discordant scream, and make for the shore with a haste so ill-advised as seriously to impede progress. Before the trees were reached, confidence would be restored, and returning, the same singular performance would be repeated, perhaps for three or four times before the game was finally secured. No enemy was in sight. The breeze would flow gently. All was serene, yet terror would take possession of the bird and almost paralyze its efforts by making it frantic. I soon learned the reason for this cowardice. Stretched at length on the deck of a boat in the early morning in the pass of Boca Grande, one of the entrances to Charlottes harbor, I saw a fine specimen of hawk cross overhead and proceed seaward to find a dinner. The excursion was successful as the pass swarmed with fish coming in with the tide. A fine one soon left its element and swung aloft into the air in the talons of the bird, which at once began its return. But a new-comer appeared upon the scene. A black creature which seemed all wings and shaped like a flattened letter M, dropped from above and confronted the hawk, which at once dropped its prey and uttered a scream so brimful of mortal terror that it should have excited the sympathy of all living things within the compass of its sound. It was not disturbed by actual contact. The two birds were not within fifty feet of each other, but the hawk exerted itself with the same wild energy to get to cover which I had before so often witnessed when no black monster was in the vicinage. The intruder was a frigate-bird, and on looking upwards a score of them could be seen a mile or more from the earth, floating round and round, on motionless wings. The dropped fish was seized in the beak of the bird long before it reached the water, and with a sweep of exquisite grace, on tense wings, fronting a mild breeze, the corsair was lifted half a mile into the air, where another astonishing performance was at once initiated. A bite was taken from the body, being torn away by a wringing motion of the head which sent the carcass whirling, while the bird masticated the morsel in shape for swallowing. Of course the fish began to obey the law of falling bodies, and the bird, folding its wings tightly upon its body, dropped swiftly after it. The part bitten off being disposed of, another swoop downwards was made, the fish seized, and the upward swing repeated, and this process continued until the entire carcass was devoured.

At the time of this visit these frigate-birds were oblivious of man's presence and I was so fortunate as to secure this one by a well directed shot. It measured eleven feet in alar dimensions and weighed eight pounds. Its feet and legs were ridiculously small and weak, and viewed as weapons of offense and defense could not compare with the talons of the hawk it had robbed and terrified. Its head and beak were strong and well developed, but by no means superior to those of the other. The terror which inspired the hawk was still unaccounted for. In a contest for superiority on the ground of physical strength and effectiveness of weapons it would have been victorious. The whole case was still enveloped in mystery.

Returning to this locality after the absence of some weeks I found the black outlines of the frigate-birds against the sky as usual, and soon saw the inevitable hawk over the waters of the pass all excitement at the prospect of a dinner. It was the beginning of March, and in that month the sea-breezes of the vicinity are particularly delightful. It is also the breeding season of the birds when their plumage is at its best, and they show to best advantage. Success always followed any well directed effort of a bird to catch a fish in Boca Grande pass, and the hawk soon had one. A black corsair at once appeared and captured the booty as on the former occasion, while the frightened fisher fled screaming towards the land. But now a change of programme took place. Another long winged creature from the group above appeared in front of and facing the frightened hawk which turned seaward at once, mingling its note of terror with one of despair. Every effort to side off towards home was frustrated by the gliding terror interposing its bulk in the intended direction, until the victim seemed to accept the inevitable and made an attempt to cross the gulf. The tormenting enemy then seemed content, and swung aloft among its companions. The poor fisherman, rid of the dire presence, wheeled on its course for home, and its frenzied flappings relieved of excessive tension, made very good time, when on reaching the very brink of safety the black wings again appeared and the whole distressing business was re-enacted with

PLATE XI.



The Frigate Bird.

increasing despair in the frightened cry. This went on for more than half an hour. Every effort at retreat was intercepted. During all the time the hawk kept up an incessant flapping of its wings, and its physical endurance was giving way under the protracted strain. This was apparent from the changing tone of its scream, which varied through all the gamut of despair, from unreasoning terror, to supplicating misery. It was the Roman gladiator's "Cæsar, the dying salute thee," with the ambition left out.

The frigate-bird at length seemed impatient. It more promptly answered the movements of the hawk, and urged compliance with greater vigor, and finally introduced a new feature into the proceedings. Swooping upwards for one hundred feet it turned head foremost, and plunged beneath the hawk, turning completely over as it did so, and passing to the front vaulted upwards, and down again in the same path, thus describing an elliptical orbit around its victim. It swung near the hawk round the lower curve, causing upward flight, until at length in an exhausted condition it was introduced into the company of its tormenters which had been descending from high levels and were now about four hundred yards above the water. Its strength was now well nigh exhausted. Its cry was scarcely audible, and it barely had the power of directing its movements. In whichever way it went, excepting one, a black terror confronted it. It could rise unimpeded, but found resistance to every other course. It struggled upwards for some four hundred yards further, until the distance was so great as to make it difficult to keep the movements in the field of the glass, when it gave up the task, and rapidly floundered over and over through the air, its muscular power exhausted, and its mass surrendered to the gravitating force. Down it came, the whole half-score of enemies circling about it, until it struck the water near the beach in the shallows of the offing. The tide was running out and the water on the flat not over a foot in depth.

Supposing the play to be out I was proceeding to examine the victim when it was evident that more was to come. The hawk was not dead and would at intervals raise its head from beneath the water to breathe. It had not strength to submerge its body, and with the vital air came a vision of the hovering terror. Down went its head with a gurgling murmur, and those black demons would alight upon it with their miserable puny feet and push it entirely beneath the surface.

The vitality of the fish-hawk is something wonderful, for this pastime went on for an hour, until at length it was completely dead. The body floated to shallow parts in the ebbing tide and rested stationary on the bottom, when each bird in turn alighted upon it, folded its wings, and rested in perfect quiet for five minutes, when it would rise in the air and a comrade take its turn. The appearance of these creatures, while thus employed, was that of quietly expecting something which did not happen. I had approached to within thirty feet of the dead hawk, but not the least attention was given to my presence. The birds always alighted with their heads towards the head of the carcass, and stood out their time, without making a movement, in a slightly crouching attitude, as if to be prepared for what would take place. This curious performance lasted for an hour, when, moved by a single impulse, they stretched their long pinions and went aloft, where they could be seen in their interminable circling flight, round and round, and the tragedy was ended.

The sun was low in the west; the tide had ceased to flow; the breeze had died away, and everything was tranquil. All nature seemed to overflow with love and peace, and yet an awful scene had filled those quiet hours. I felt myself in the grasp of something infernal. It was as if the guest of Solomon had been confronted in the garden, in every avenue of escape, by awful death, until he had surrendered life after exhausting all the forces of his nature to escape his doom. An examination of the carcass revealed no wounds. It was a case of suicide entirely. But what a dreadful motive to commit the deed.

Through all this tragedy the wings of the frigate-birds were motionless, excepting when they were engaged near the water. To rise or fall was indifferent to them. When confronting the hawks, the contrasted wing-motions of the two birds was conspicuous—one was beating the air rapidly, the other not at all. Though afterwards explained, this ability to counteract air resistance and weight without muscular exertion was then as great a riddle as any other part of the work.

I remained in that locality for a month, but witnessed no repetition of this day's tragedy. The frigate-birds occupied the air and the hawks fished in the pass undisturbed, or if their prey was stolen, they were allowed to escape; but on returning a year afterwards, I witnessed an analogous scene, after waiting for weeks for the event to occur. A hawk, quite differently marked and much larger than those usually seen, crossed from the opposite key and struck a fish from the passing school, which was promptly seized by the waiting frigate-bird. The hawk fled in terror, as usual, and was confronted by another of the band and, on examing the sky, still another, three in all, was seen. After the confronted hawk had turned, it seemed to lose its terror, its cry denoting submission, a sort of querulous surrender to the inevitable. To my surprise, it resumed its fishing, while the rover retired. It soon secured another from the teeming waters, for all it had to do was to pick it up. This was captured and the screaming retreat once more arrested. A simple hint was quite enough. The slave returned to its task with many an unnoticed murmur, until each bandit had secured a feast. The hawk then escaped hungry, and disappeared from sight.

After witnessing this way of getting a living, a black garment seemed lifted from nature. The method was so like that practiced by man, as shown in history, that it quite contented me. These frigate-birds are the banditti of the air. During a residence of five years on that coast, I never saw one get an honest living. They seem to be the especial favorites of nature, as the cosmical force of gravity is placed at their disposal, which is a little like giving them the lamp of Aladdin. Small use would it be for a creature required to provide its own motive power to sustain itself in air, and also that required to fight a battle for life, to oppose such odds. The relation to success such combatants would stand in would be almost infinity to one.

A familiar sight along that coast, at all seasons of the year, is that of gulls riding on the backs and heads of pelicans and feeding on the fish from their gullets. There is a good understanding between these creatures, and I never saw them quarrel. Sometimes when fish were scarce and the small intruders wanted all, a contest as to which could swallow the most in the shortest time took place, to the usual discomfiture of the little ones, who never seemed to understand how nor why the food disappeared. This scheme of subsistence-supply gave the missing link needed to acquit nature of deliberately plotting the torture of her creatures. Away back in the great secondary age, when reptiles navigated the air on wings, the characteristics of a frigate-bird may have been initiated. In the life-struggle, habits of the gull were acquired which led the creature, *then* neither frigate-bird nor gull, to get its food by association with some messmate more able to procure it. Then these two forms diverged from the common ancestor, acquiring new traits from new environments. As the frigate-birds gained dominion of the air, they also gained dominion of species of fish-hawks, which became enslaved by them. But the hawks also diverged into other species, one or more of which retained the terror, but not the discipline, and, when commanded, would not comply, through sheer ignorance of the nature of the demand. When the birds met with a specimen of this branched stock, they urged obedience with such vigor as to result in the death of their unfortunate victim. Then the old ancestral habit, which may be had outlived a thousand generations, comes into play, and they stand on the dead body, in pure friendship, waiting to be fed! What do they know of the mystery of death? The only weak place is where the branching hawk forgot the duty of fishing for its master, but not the terror of its presence. But then fear is what prompts it to escape from an enemy and thereby save its life, so that this emotion would properly survive the other.

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A STUDY OF GARDEN LETTUCE.

BY E. L. STURTEVANT, M.D.

AT the New York Agricultural Experiment station, in 1885, eighty-three distinct varieties of lettuce were grown under nearly two hundred names. These lettuces present to the onlooker three distinct form-species, the lanceolate-leaved, the Cos and the cabbage. It is a pertinent inquiry as to whether these form-species are of distinct origin or have been produced by cultivation within recent times, and we hence offer a succinct account of our historical investigations.

The lanceolate-leaved form is represented with us by one variety only, the deer's tongue, introduced as a seedsman's novelty in 1883. The type of this form is perhaps referred to by Pliny, lib. XIX, c. 38, "præterea longi et angusti intubi similis," as this plant of ours has a chiccory-like appearance in some stages of its growth. It is certainly mentioned by Bauhin[1] in 1621, and credited in his synonomy to Castor, 1585; and is figured by Bauhin[2]

[1] Pinax, ed. of 1621.

[2] Prodromos, ed. of 1671.

in 1671. Vilmorin,[1] 1883, refers to this type of lettuce under the name *Romaine asperge*, *Lactuca angustana* Hort., and a variety *L. cracoviensis* Hort. *L. angustana* Allionii, 1785, seems to be of this form-species, and is recorded as found wild in Switzerland, and Martyn's Millers Dictionary deems the *Chicoreum constantinopolitanum* of Parkinson, 1640, to have some affinity to it.

The Cos lettuces are distinguished by the upright growth of the root leaves and the elongated and spatulate form of the leaf; they are also subject to a flattening of the stalk through fasciation. They were perhaps known to the ancient Romans, as witness Pliny's[2] statement: "Diligentiores plura genera faciunt: purpurea crispas, Cappedocas, Græcos. Longioris has folii, caulisque lati; præterea longi et angusti, intubi similis." Palladius'[3] mention of the process of blanching can be also quoted: "Candidæ fieri putantur, si fluminis arena vel litoris frequentur spargatur in medias, and collectis ipsæ foliis alligentur." The Cos lettuce is the Lactuca Romana dulcior, nigriore and Scariole hortensis folio, semine nigro of Pena and Lobel,[4] 1570. Bauhin in his Pinax considers this form to be the L. foliio obscurius virentibus nigra Plinio of Dodænus,[5] the *L. nigra* of Cæsalpinus, 1583, and the *L. romana* of Castor Durantes, 1585. In the sixteenth century the Cos form seems to have been less grown in Northern Europe than in the south, for Pena and Lobel[6] say it is rarely cultivated in France and Germany, more frequently in Italy, especially at Rome. It reached France in 1537.[7]

The class of cabbage lettuces are distinguished by the rounded and spatulate leaf which grows less upright than the Cos. Although the commentators of the sixteenth and seventeenth centuries deem this class to have been known to the ancient Greeks and Romans, and identify it with the Laconicon of Pliny and the Tartesian or Bætica of Columella, yet I am unable to find any certain evidence. The only word I find in Pliny which could suggest this class is "crispa," which may be translated "wrinkled," and as a class the cabbage lettuces are more wrinkled or

[1] Les Plantes Potageres.
[2] Nat. Hist., lib. XIX, c. 38.
[3] De Re Rustica, lib. II, c. 14.
[4] Stirpium Adversaria Nova, Londini, 1570, p. 90.
[5] Pemptades, 1621, p. 644.
[6] Loc. cit.
[7] *Herze. Lesve. Alim. i, p. v.*

blistered than are the Cos. Columella was a native of Gades, but resided principally at Rome. He[1] speaks of two kinds which may belong to this class, one the Cappadocean "Tertia, quæ spisso, sed puro vertice pallet," and "quæ pallido and pexo densoque folio viret;" the other the Tartesian or Bætica, which he says is from his country:

"Et mæ, quam generant Tartesi litore Gades
Candida vibrato discrimine, candida thyrso est,"

and "quæ deinde candida est and crispissimi folii, ut in provincia Bætica and finibus Gaditani municippii." The words "vibrato discrimine" and "crispissimi folii" would imply a curled cutting lettuce. The heading lettuces of this class were, however, well known to the writers of the sixteenth and seventeenth centuries. Anton Pinaeus,[2] 1561, figures one which closely resembles the stone tennis ball variety of our gardens, and Bauhin in his synonymy identifies with varieties described by Tragus, 1553, Tabernæmontanus 1588, Matthiolus 1586, Gerarde 1597, etc., etc.

Whether the types of the Cos and the cabbage form-species occur in nature, I have not the material for study to determine. De Candolle[3] says "botanists are agreed in considering the cultivated lettuce as a modification of the wild species called *Lactuca scariola.* The latter grows in temperate and Southern Europe, in the Canary isles, Madeira, Algeria, Abyssinia and in the temperate regions of Eastern Asia. Boissier speaks of specimens from Arabia Petrea to Mesopotamia and the Caucasus. He mentions a variety with crinkled[4] leaves, similar, therefore, to some of our garden lettuces, which the traveler Hausknecht brought with him from the mountains of Kurdistan. I have a specimen from Siberia, found near the River Irtysch, and it is now known with certainty that the species grows in the north of India, in Kashmir and in Nepal." From this reference we might infer that the Kurdistan form belonged to the cabbage type, as possessing distinctly wrinkled or savoy-like leaves, while the description of the ordinary *L. scariola* of Europe implies the Cos type.

I have not opportunity of access to herbariums whereby I can hope to satisfy myself of the condition of the wild forms from

[1] De Re Rustica, x, l. 183; xi, c. 3; x, l. 185.

[2] Hist. Plants, 1561.

[3] Origin of Cultivated Plants, 1885, p. 95.

[4] The word in the original French edition, p. 76, is *crispee*, which should rather be translated wrinkled or bullate.

various countries, but such evidence as I have here outlined strongly supports the hypothesis that our three form-species of lettuce have originated from wild forms which have been brought into culture in different regions, and hence that our three form-species have different origin. The history of lettuce as published affords no clue towards settling this point. Lettuces are supposed to have been grown by the Persians some five hundred years before Christ, and to have been introduced into China between the years 600 and 900 of our era; they were mentioned by Chaucer in England in the fourteenth century, and reached America with Columbus.

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AQUATIC RESPIRATION IN SOFT-SHELLED TURTLES: A CONTRIBUTION TO THE PHYSIOLOGY OF RESPIRATION IN VERTEBRATES.[1]

BY SIMON H. AND SUSANNA PHELPS GAGE.

IT was formerly supposed that in all reptiles the respiration was exclusively aërial at all periods of their life, and that the lungs were the only respiratory organs. We have demonstrated, however, that in soft-shelled turtles (*Amyda mutica* and *Aspidonectes spirifer*) there is in addition a true aquatic respiration. This is *indicated* by three facts: (*a*) These turtles remain most of the time in water, and voluntarily remain entirely under from two to ten consecutive hours; (*b*) while under water they fill and empty the mouth and pharnyx, about sixteen times per minute, by movements of the hyoid apparatus, the general appearance being like the respiratory movements of a fish; (*c*) the mucous membrane of the pharynx is closely beset with filamentous processes, appearing like the villi of the small intestine of a mammal or the gill filaments of Necturus. These processes are especially numerous along the hyoid arches and around the glottis, and are copiously supplied with blood.[2]

[1] A preliminary paper upon the respiration of Aspidonectes was presented to the A. A. A. S. by the senior author in 1883, and printed on p. 316 of the Proceedings (Vol. XXXII).

[2] So far as we know but two original observations (besides that mentioned in the preceding foot-note) have been previously made upon the Trionychidæ bearing upon the subject of this paper: (*a*) In February, 1856, Dr. A. Sager called attention to the processes in the pharynx of Aspidonectes, and compared them, in appearance, with the gill filaments of Necturus and the inner gills of tadpoles. (*b*) Professor L.

But neither the time the turtles remain under water, the filling and emptying of the mouth and pharynx with water, nor even the structure of the parts, proves that aquatic respiration occurs. Final proof of this is only obtained by comparing the free gases found in water with those found in water from the same source after a turtle had been submerged in it without access to air. Water so tested showed in one case that a turtle weighing one kilogram in ten hours removed from the water seventy-one milligrams of free oxygen and added to it 318 milligrams of carbon dioxide. Several other determinations were of the same conclusive character.[1]

This indicates a respiration for the same body weight of about one twentieth of that occurring in man.

As indicated by the figures given above, the carbon dioxide is greatly in excess of what could be accounted for by the free oxygen taken from the water. There are two sources from which the extra oxygen might be derived: (*a*) From the so-called intra-

Agassiz, in Part II of the Contribution to North American Zoölogy, p. 284, says: "Before reading this paper [Dr. Sager's] we had noticed these organs [processes in the pharynx]; but after seeing this turtle [Aspidonectes] remaining under water for full half an hour without showing the least sign of oppression, it seems plausible to assume that these fringes may be similar to the internal gills of tadpoles, not only in their shape but also in their function. There exists, moreover, an extensive network of beautiful vessels spreading in elegant dendritic ramifications upon the whole lower surface of the Trionycidæ which can hardly have another function than that of assisting in the process of breathing, as they are too numerous and too large to be considered simply as nutritive vessels of the skin. This is the more probable as these vessels are very superficial and are only covered by a very thin epidermis. They are indeed as plainly visible through the horny layer which protects them as the vessels of any special external breathing organ." * * *

[1] The following table shows the results of three analyses. In the first column is given the total amount of free oxygen taken from the water (ten liters) in ten hours by a turtle weighing one kilogram. The second column contains the quantity of carbon dioxide that could be formed from this oxygen; and the third column contains the actual amount of carbon dioxide added to the water by the turtle, the excess of which, over the amount that could be formed from the oxygen taken from the water, is given in the fourth column:

	O.	*CO_2.*	*Actual CO_2.*	*Excess CO_2.*
July 11......	71 mg.	97 5-8 mg.	231 mg.	133 3-8 mg.
Aug. 8......	32 "	44 "	212.7 "	168.7 "
Aug. 9......	39 "	53 5-8 "	168.7 "	115 3-40 "

The determinations were made with the greatest care and accuracy by Professors Rich and Holton in the chemical laboratory of Cornell University.

molecular oxygen stored up in the tissues, and (*b*) from the air in the lungs. Analysis of the air taken from the lungs after the turtle had been wholly submerged for ten hours, showed only a slight trace of either oxygen or carbon dioxide. So far as this single experiment goes, we conclude that if the lungs were moderately filled with air upon the immersion of the turtle, the amount of oxygen that might be taken from the air in the lungs would fully account for the excess of carbon dioxide found in the water. That the aquatic respiration is due almost entirely to the pharynx and but slightly to the skin, is shown: (*a*) By anæsthetization, the turtle becoming anæsthetized four or five times as quickly when kept entirely submerged in ætherized water as when allowed to come to the surface as frequently as it desired. (*b*) When the turtle's skin was completely covered with vaseline and the turtle kept wholly submerged, the amount of oxygen removed from the water and of carbon dioxide added thereto was nearly as great as when the skin was unvaselined.

In some at least of the hard-shelled turtles (Chelydra and Chrysemys) similar movements of the hyoid apparatus occur when they are submerged, and water is seen to enter the nostril and be expelled therefrom as in soft-shelled turtles.

The pharynx expands and contracts with considerable regularity in all of the turtles, so far as we know, when they are in the air. These movements appear like those of the frog, but in the turtles they are unnecessary for filling the lungs. In frogs, however, they are necessary for this purpose, although as shown by Townson (1794), pharyngeal movements often occur in the frog without any air being forced into the lungs.

As these movements are of undoubted use in respiration for the soft-shelled turtles in water, it seems probable that they may be of use in respiration for all turtles in the air, that is, the membrane lining the pharynx probably acts as a respiratory organ whether the medium bathing it and containing free oxygen be air or water.

These movements and their object, respiration, then seem to connect, physiologically at least, the turtles on the one hand with the lower vertebrates—Amphibia and fishes—and on the other hand with the higher forms, viz., dog and man, for Garland has shown that in the dog, and also in man, occur rhythmical pharyngeal movements which draw air into the pharynx and expel it whenever there is a condition approaching asphyxiation. It seems as though these pharyngeal movements reappear in the highest forms when the want of oxygen becomes overwhelmingly great, as if there were an organic memory of the means by which, in the dim past, the want was supplied.

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DESCRIPTION OF A NEW SUBSPECIES OF THE COMMON EASTERN CHIPMUNK.

BY C. HART MERRIAM, M.D.

THE common chipmunk or striped squirrel of Eastern North America was first mentioned, so far as I have been able to ascertain, by Sagard-Théodat in his Histoire du Canada ("Vol. v, p. 746"), published in 1615. In 1743 Mark Catesby gave an unmistakable description of it, accompanied by a recognizable colored plate.[1] He called it *Sciurus striatus*, which name was adopted by Linnæus in the tenth edition of his Systema Naturæ, published in 1758. The specific name *striatus*, after enduring the vicissitudes to which scientific nomenclature is so often subject,[2] was reëstablished by Baird in 1857, and has since enjoyed undisputed recognition on this side of the Atlantic.

It is a little singular that thus far no one seems to have suspected the existence of two distinct subspecies of chipmunk in Eastern North America, particularly when it is remembered that no less than five geographical races of the Western species have long been recognized.

It is true that Professor Baird, nearly thirty years ago, stated that a chipmunk from Essex county, in Northeastern New York,

[1] "SCIURUS STRIATUS. *The Ground Squirrel.* This is about half the Size of an English Squirrel, and almost of the same Colour, except that a Pair of black Lists, with a yellowish white List between them, extend almost the Length of the Body on both Sides; also a single black List runs along the Ridge of the Back. The Eyes are black and large, the Ears rounding, the Tail long, flat, and thick set with Hairs, which are much shorter than those of other Squirrels. These Squirrels abide in the Woods of *Carolina*, *Virginia*, &c. Their Food is Nuts, Acorns, and such like as other Squirrels feed on. They being brought up tame, are very familiar and active." (Natural Hist. of Carolina, etc., by Mark Catesby, Vol. II, 1743, p. 75).

[2] For more than half a century our animal was confused with the Asiatic, but it is not the purpose of the present paper to enter into a discussion of the complicated synonymy of these species, already very fully elaborated by Allen. (Monographs of North American Rodentia, 1877.)

"is considerably grayer, and the black lines of the back have no brownish margin. In a specimen from Washington [D. C.], the chestnut tints are darker than described above" (North American Mammals, 1857, 294). But his material was not sufficiently extensive to enable him to appreciate the constancy and significance of the differences noted.

Allen, in his most valuable paper on Geographical variation in color in North American squirrels, said: "The increase in intensity of color from the north southward" is well illustrated in "*Tamias striatus*, representatives of which from the southern parts of New York and Pennsylvania are much more highly colored than are those from Northern New England and the British Provinces" (Proc. Bost. Soc. Nat. Hist., XVI, 1874, 4). Later, however, the views above expressed seem to have undergone some modification, for the same author observes: "The very large number of specimens before me indicate that the present species preserves great constancy of coloration. * * * Specimens from Southern localities are considerably brighter colored than those from more Northern sections, and average a little smaller. The difference, however, in either respect, is not very great" (Monographs of North American Rodentia, 1877, 784–785).

The examination of more than two hundred specimens has led me to differ with Mr. Allen in his last expressed views. His remarks concerning the deepening of color southward might have been stated more strongly, and still fall within the limits of truth.[1] In respect to size, if the body as a whole was meant, my measurements of upwards of one hundred specimens in the flesh do not show the Southern animal to be the smaller, and the largest individual that has fallen under my notice came from Monticello, Mississippi. If, however, we turn to the extremities, the case is different, for the length of both fore and hind feet is greater in northern than in southern specimens, as shown in the accompanying tables:

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[1] Mr. Allen's views, as above enunciated, were based upon the examination of upwards of one hundred and fifty specimens; still, it is but fair to state that the great majority of these specimens came from Northern localities, and were either typical of the Northern form or intermediate between it and the Southern. He had but four skins from so far south as Washington, D. C., and had not seen a single individual from the Carolinas.

MEASUREMENTS OF FEET, SHOWING DECREASE IN SIZE FROM THE NORTH SOUTHWARD.[1]

Locality.	*Manus.*	*Pes.*	*Condition when measured.*
Locust Grove, New York (average of 28)......	22.11	36.17	In the flesh.
Sing Sing, New York (average of 8)..........	21.71	34.77	" "
Washington, D. C. (one specimen)	20	34	" "
Charleston, S. C. (one specimen)...............		34	Skin [2]

It must be remembered that the above measurements of New York specimens are averages. The largest manus from the Adirondack region measures 23mm; the largest pes 38mm. The smallest manus from the Lower Hudson measures 20mm; the smallest pes 34.

In the summer of 1884, Dr. A. K. Fisher, at my request, sent me several chipmunks from Sing Sing, New York, in the valley of the Lower Hudson. On placing them alongside my own series from the Adirondack region I was at once struck with the marked differences between them, and was convinced that they were subspecifically separable. This opinion was confirmed the following year by the acquisition of an adult female from the mountains of North Carolina, kindly presented to me by Mr. William Brewster, who killed it in the town of Sylva, Jackson county, North Carolina, May 30, 1885. This individual, for two reasons, may be regarded as the type of *striatus* proper: First, because it came from the same general region from which Catesby's probably came (and it will be remembered that Linnæus's diagnosis was based on Catesby's description and figure); and, second, because it is representative of a phase of pelage most remote from that of the Northern animal. This skin (No. 1450 Mus. C. H. M.) is very much darker than the darkest Washington example I have seen, and the ferruginous of the rump is restricted in extent, and is overcast by the liberal admixture of black-tipped hairs. There is an obscure dark spot at the end of the nose above, and another at the posterior angle of each eye. The eyelids are buff, and the color of the lower lid can be traced backward, though becoming very faint, to the lower margin of

[1] The measurements here given, as well as all others which appear in this paper, were taken by myself with dividers; all were made with the utmost care, and a large proportion were verified by duplicate measuring.

[2] All measurements from skins were taken in the following manner: The feet were dipped in hot water, and then wrapped with wet cotton-wool and left for several hours until the joints became flexible, so that the toes could be straightened readily.

the auditory meatus. There is an indistinct dark line above the light line of the upper eyelid, and a broad, but not well defined, dark stripe below the light under eyelid, extending from a point anterior to the eye to a point just below the posterior base of the ear, where it becomes lost in the grizzled rusty-brown of the sides of the neck. Below this stripe, the side of the face is fulvous. The crown is dark rust-brown intermixed with a large quantity of black hairs, and the same color extends over the anterior half of the inner surfaces of the ears, the posterior half being light fulvous or buff. There is a small. light spot behind the base of each ear. The shoulders and back between the lateral stripes are very dark grizzled iron-gray, with a sprinkling of buff or yellowish. The dark stripes are not perfectly clear black, and their ferruginous borders are not well defined. The median stripe extends from the occiput nearly to the root of the tail. The light stripes are dark buff intermixed with dark-tipped hairs. The sides are buffy-fulvous well sprinkled with black-tipped hairs. The rump, hips, and backs of the hind legs are dark rusty-brown. The upper surfaces of the feet are ferruginous. The upper side of the tail is blackish, edged with hoary; the under side, deep hazel (almost chestnut), bordered with black and edged with hoary. This rich hazel of the under tail extends continuously forward over the anal region to the genitals, where it terminates abruptly without shading, off into the surrounding white. The under parts, from the mouth to the genitals, are clear buffy-white.

Through the kindness of Mr. William Brewster, Curator of Mammals and Birds in the Museum of Comparative Zoölogy at Cambridge, Mass., and of Mr. F. W. True, Curator of Mammals in the United States National Museum, I have been enabled to examine the chipmunks contained in these collections. I am indebted also to Mr. William E. Saunders for the loan of a specimen from London, Ontario, Canada. These specimens, together with my own (which in numbers exceed all the others combined), constitute a very complete series of the Eastern animal from the region between Canada on the north and Washington, D. C., on the south.

Comparison of representatives from the extremes of this range brings to light the following differences: The crown in typical Northern specimens varies from pale to bright rusty-fulvous, while in typical Southern examples it is dark rust-brown.

The nape and the back between the median and first lateral black stripes are clear ash-gray in the Northern animal, while in the Southern these parts are dark iron-gray, more or less mixed with grizzly. In specimens from the Mississippi Valley, the same parts show a sprinkling of yellow-tipped hairs.

The light lateral stripes are white, or but faintly tinged with buff in typical Northern specimens, while in typical *striatus* from the South they are strongly washed with buff, which color often deepens to pale fulvous posteriorly, and is further obscured by the admixture of a number of dark-tipped hairs. The sides vary from the palest buff (as in specimen No. 1200) or buffy fulvous in the Northern to dark fulvous in the Southern form. Northern specimens show a slight sprinkling of black-tipped hairs, which increase in number from the north southward till in typical *striatus* the admixture of these hairs very materially darkens the sides of the animal. In typical Northern examples, the pale buff of the sides fades so gradually into the white of the belly that no sharp line can be drawn between them; while in typical *striatus*, on the contrary, a very clear line of demarkation separates the two, the (comparatively) dark sides contrasting strongly with the buffy-white of the under parts, even when these parts are suffused with fulvous—which fact is due to the absence of black-tipped hairs from the belly.

The upper side of the tail is much lighter in Northern specimens than in *striatus* proper, though the hoary edging is more conspicuous in the Southern. This difference in appearance is due to the fact that the black subapical portion of each hair is much broader in the latter than in the former, and the subbasal fulvous portion proportionately narrower. The result is that in the Northern animal the pale fulvous zone shows through, while in the Southern the corresponding zone is mostly concealed by the overlying black. In typical Northern specimens the under side of the tail is buffy or buffy-fulvous, fading in the anal region into the white of the belly; while in typical *striatus* the under side of the tail is deep hazel, which color extends forward around the anus to the genitals, where it ends abruptly without shading off into the surrounding parts.

The dark spot above the tip of the nose is usually indistinct and sometimes wanting in Northern specimens, while as a rule it is well marked in those from the South. The facial markings, on the other hand, are more distinct in the Northern than in the Southern animal. These markings, however, vary so much in individuals in respect to clearness of definition that they may be dismissed as unimportant in the present connection.

In brief, it may be said that the Northern animal differs from the Southern in the clearness and lightness of its colors, the black stripes remaining much alike in both; or, conversely, that the Southern is characterized by an intensification of all the colors, resulting in the darkening of the entire upper surface.

Richardson, in 1829, seems to have been first to describe the Northern form, though he did not suspect it to differ from the Southern. Believing that the specific name *striatus* belonged to the Asiatic animal, and assuming the American to be distinct, he called the latter "*Sciurus* (*Tamias*) *Lysteri.* (Ray.)," but was wrong in supposing that Ray had named it before him. Baird expressed the matter in a nutshell when he said, " This author [Richardson] quotes Ray as the authority of this name, but it is, in fact, his own—Ray only referring to the species as *Sciurus a Clar. Dom. Lyster observatus*" (North American Mammals, 1857, p. 295).

Richardson's account of the animal he had in view admits of no question as to its exclusive applicability to the present form, and his plate (plate xv), though uncolored, is equally unmistakable. Furthermore, he distinctly states that his specimen came from Penetanguishene, which is on the north-east arm of Lake Huron, a region which, theoretically at least, ought to furnish most typical examples. His description was taken from " a recent male specimen, killed in April at Penetanguishene." The portion of it relating to color runs as follows:

" *Colour.*—The dorsal aspect of the head is covered with yellowish-brown hairs, which are mixed with a smaller number of black ones. There is a black spot near the tip of the nose. The eyelashes are black, the eyelids white; there is a dark-brown streak between the eye and the ear, and a broad, yellowish-brown stripe extends from the nose, under the eye, to behind the ear, deepening in its middle to chestnut-brown. The anterior part of the back is hoary-gray, from a mixture of black and white hairs. The rump, hips and exterior surfaces of the thighs are of a bright orange-brown color, mixed with a few black hairs. A dark dorsal line commences at the occiput, and reaches to within an inch of the tail. This line is brownish at its commencement, but deepens to black posteriorly. There are also, on each flank, two black lines, which commence behind the shoulders, extend to the hips, and are separated by a moderately broad white stripe. All these stripes are more or less bordered with brown. The sides, beneath the stripes, present a mixture of gray and very light brown. The fur, covering the throat, chin, belly, and inner surface of the extremities, is longer and thinner than that on the dorsal aspect, and is white throughout its whole length. The fur on the upper parts of the body forms a smooth coat, and is blackish-gray at its roots. There is no defined line of separation betwixt the colors of the back and belly." (Fauna Boreali-Americana, Richardson, 1829, pp. 182–183.)

Hence it is clear that Richardson's name *lysteri* must be adopted as the subspecific name of the Northern animal.

Following are diagnoses of the two races:

TAMIAS STRIATUS TYPICUS.—Manus, 20 to 21mm; pes, 34 to 35mm; crown, rusty brown or grizzled brown; nape and back nearly to rump iron gray, sometimes mixed with grizzly; rump, dark ferruginous, sometimes almost chestnut; sides, russet fulvous, passing into ferruginous over the hips, and mixed with a variable quantity of black tipped hairs, the fulvous (losing its black hairs and becoming paler) sometimes encroaching upon the buffy white of belly and occasionally meeting irregularly along the median line below, but always leaving a well-defined line of demarkation between the sides and belly; light lateral stripes strongly suffused with buff and sometimes tinged with fulvous posteriorly; under surface of tail, mesially, dark fulvous to hazel, often very deep.

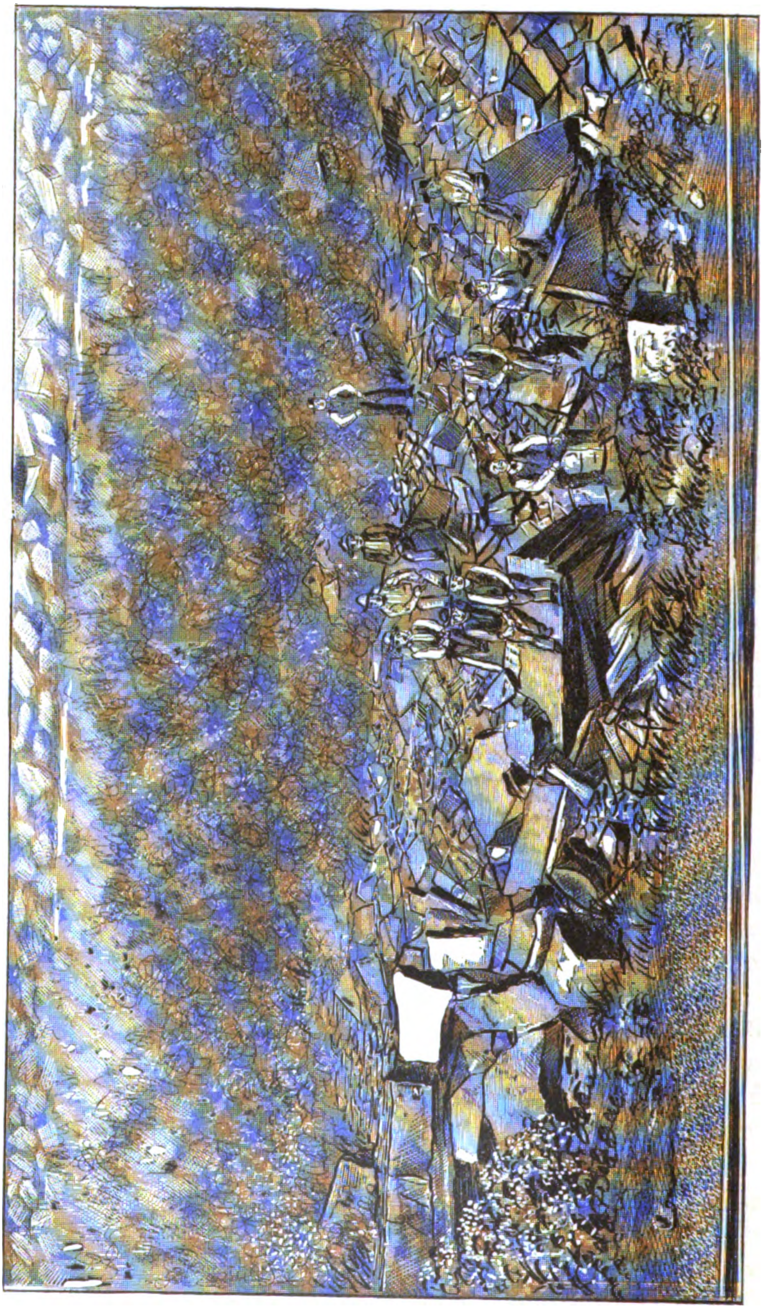
Habitat.—Valley of the Lower Hudson and Long Island, New York; New Jersey; and southward in the highlands to the Carolinas and Georgia.

TAMIAS STRIATUS LYSTERI (sub-sp. nov.).—Manus, 21.5 to 22.5mm; pes, 36 to 37mm; crown, rusty fulvous, sometimes very pale; nape and back nearly to rump clear ash gray; sides, pale buff, fading into white of belly without leaving any sharp line of demarkation between them; light lateral stripe nearly white, at most but faintly washed with buff; under surface of tail, mesially, pale buff to tawny buff.

Habitat.—Mountains of Pennsylvania; Adirondack region of New York; Northern New England; Eastern Canada north to the Gulf of St. Lawrence, and in the interior north to James's Bay, Hudson's Bay.

Coupled with the foregoing external characters, which serve to separate the Northern from the Southern animal, are certain cranial peculiarities which are equally constant and distinctive. Publication of these differences is deferred until a better series of skulls of the Southern form can be obtained. It may be stated here, however, that the brain case is a little broader in typical *striatus*, while the length of the molar series of teeth is greater in *lysteri*.

PLATE XII.



Ledge of Triassic slate and sandstone at Weehawken, N. J., yielding fish remains.

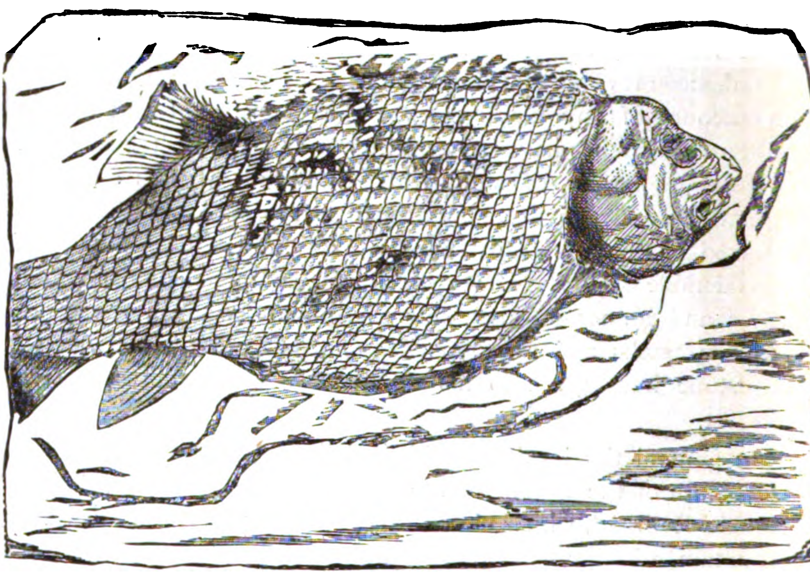
FISH REMAINS AND TRACKS IN THE TRIASSIC ROCKS AT WEEHAWKEN, N. J.

BY L. P. GRATACAP.

THE indurated and fissile shales that crop out beneath the superimposed masses of trap rock along the western bank of the Hudson river at Weehawken, Gottenburg and neighboring localities, have been frequently explored for fish remains. Their unequivocal position as Triassic slates, and the interesting developments made by I. C. Russel at Boonton, N. J., some years ago, in beds of an identical character, stimulated collectors to hunt here for similar fossils. As far as I know there is no published account of any success met with in the search, or indeed an account of any kind. Estheria in compressed and almost obliterated patches have been taken out, but the fish beds kept discouragingly out of sight. Mr. F. Braun, of this city, has recently revealed a large number of fish remains in the slates referred to, and has most successfully extracted specimens of considerable beauty. These specimens comprise almost whole fishes and numerous instructive fragments, while a few plant remains, tracks and ripple-marked blocks from the underlying sandstone have given to his discovery a more comprehensive interest.

In general the locality established by Mr. Braun is about 800 feet south of the mouth of the tunnel of the N. Y., W. S. and Buffalo Railroad, which pierces the trap ridge known as Palisade mountain, a long exposure of basalt limited by Professor Cook as follows: "It may be said to start near the Highlands west of Haverstraw, in Rockland county. The range is continuous to Bergen point. It reappears south of the Kill von Kull on Staten island, and finally disappears near the Fish Kills. Its total length from Ladentown, N. Y., to the Staten Island sound, is fifty-three miles."

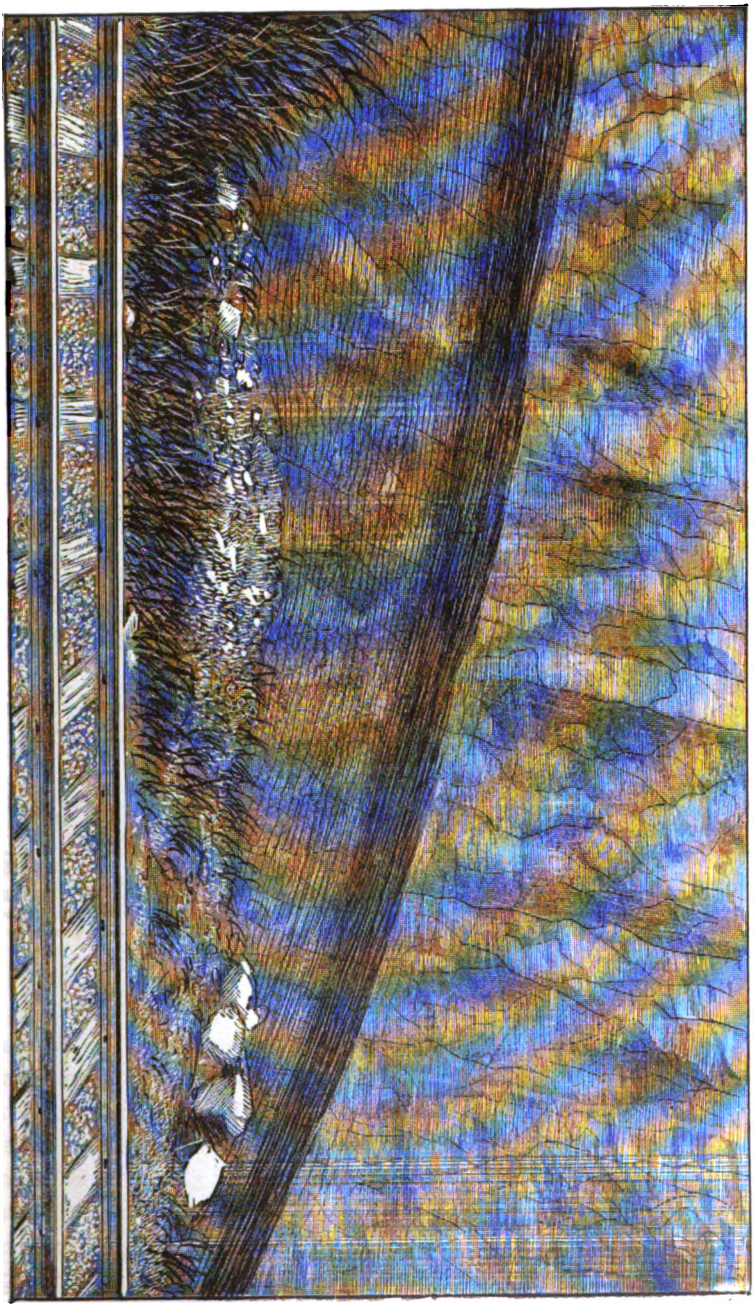
Mr. Braun commenced his quarrying in a bed of slates directly underlying the trap rock which rises in perpendicular walls far above it, and found his fish and plant remains restricted to a narrow layer of from three to four inches in thickness, and towards the base of the entire slate bed. An examination of the ledge, of which this bed formed a member, showed a succession of slate, sandstone, slate and trap. At the bottom, forming a low shelf whose base was buried in the alluvium, was a slate group formed of closely compacted laminæ of slate in conformable contact with a bed of sandstone, which at the line of union with the slate was granular and siliceous, becoming compact and feldspathic on its upper side, where it becomes almost fused with a second bed of slate, the fossil layer, above which rose the trap cliff. The exposure of the first slate bed had a thickness of five to six feet, the thickness of the sandstone was four feet, and that of the fossil



Palæoniscus latus Redfd., Weehawken, N. J.

group, as far as could be determined, eight feet, when the base of the trap was reached. The average dip of the series was 17° N. W., and the strike N. N. E. Two photographs were taken, one of the ledge itself (Plate XII), formed of the three beds, and a second at the mouth of the great tunnel, some 800 feet north of this point, where the fossil layer of slate rock with its lines of bedding can be seen conspicuously meeting the trap, fissured by crevices of vertical cleavage (Plate XIII). The first photograph was rather unfortunately invaded by a local group of sitters bearing no sensible relation to its particular object. The standing

PLATE XIII.



Contact line between inclined slate bed bearing fish remains, etc., and trap, at Weehawken, N. J.

figure at the top marks the fossil layer of slate and the location of Mr. Braun's find.

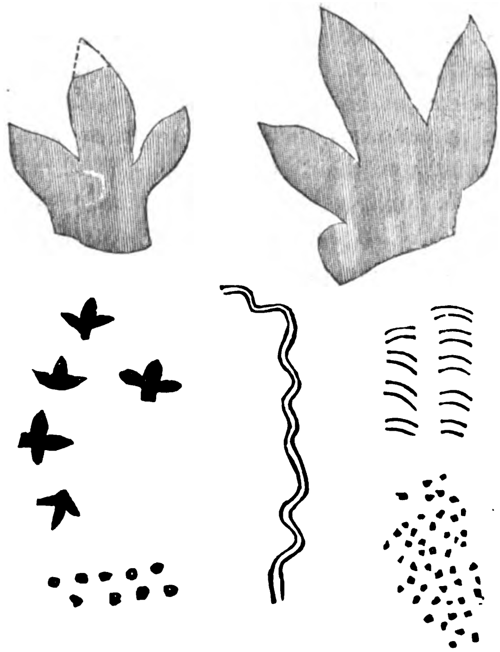
The fossil remains taken from the slate comprise casts and impressions of plant-roots or root-like fragments, the lobate divisions of an aquatic plant, an enigmatical nut displaying its coaly and black nucleus, and numerous fishes in various stages of preservation, and in positions that seem to throw a light upon the local circumstances of their entombment. Mud cracks reticulate the slate slabs in ramifying lines, the silent witnesses to processes along the shores of an ancient Triassic estuary, identical with those that produce to-day the same markings upon a sun-baked bar.

One of the best examples of the fishes in Mr. Braun's collection, now in my possession, is shown in the foregoing sketch.

I think all the fish remains I have are identical with this one as to genus and species, and it appears identical with *Palæoniscus latus* Redfd. On a specimen, other than the one figured, the dorsal fin shows the coarse raylets attached to the anterior spine, and its position, although quite far back, does not correspond to the insertion given for Catopterus. The fishes are found laterally compressed and usually straight, but in some instances the creature has become doubled and turned over on itself as if entrapped while wriggling in its contortions to escape again to the water, which receding left it exposed upon a muddy flat.

Many have become macerated, and the surrounding shale is strewn with their scattered scales, whose disconnected marks gradually become closer in one direction, leading the eye to a formless cluster of scales and head-parts. Most of the specimens suggest that the fishes perished in numbers and were buried beneath later films of detritus as they lay motionless upon their sides. The locality so lately discovered may reveal more of interest both as regards these fish in their zoölogical status, the character of their habitat and the manner of their death. I have found in these slates lenticular masses of a pulverulent and highly carbonaceous material which yielded seven per cent of combustible matter, and would doubtless have reacted for phosphoric acid. They seem connected with the organic occupants of the rocks, and may have arisen through their decomposition.

In the sandstone below this slate Mr. Braun has found impressions, the most striking of which are shown in the wood-cut, suggesting tracks.



Tracks and markings on Triassic sandstone at Weehawken, N. J.

Ripple marks and rain fossæ on other slabs help vividly to recall a shore upon which these ancient waters of the Triassic basin washed, laving the forms of amphibious reptiles or pouring over crawling Crustacea, while showers beat upon the imprinted sands; and on shelving and shallow bars the ripples sculptured their counterparts in gentle furrows.

———:o:———

RESEMBLANCES IN ARTS WIDELY SEPARATED.[1]

BY OTIS T. MASON.

FROM the times of the earliest travelers down to the present day, we have narratives of the occurrence of the same inventions (implements), practices, modes of speech, institutions, theories, and religious creeds and cults in regions wide apart.

The older historians and ethnologists were wont to say that

[1] Read before the Washington Philosophical Society, Jan. 30, 1886.

similarity of human actions argued consanguinity in those who practiced them, that when the same phenomena occurred in two places they must have had their origin from the same race. Those who hold such theories are not all dead, as any one conversant with recent literature well knows. It is quite possible also that among older thinkers there were other ways of accounting for such similarities as I have mentioned.

Before speaking of another explanation it is necessary first to examine more closely the old doctrine. Admitting that all like inventions had their origin from the same race, we have two possible ways by which each one may have been planted in different parts of the world. An art may be so peculiar to a people that its presence argues their presence always, in which case the art may be said to have the same inventor and executor. An art may originate with a race or people, some of whom may carry the knowledge of it everywhere, or foreigners visiting that people may learn the art and carry it home, or it may, undesignedly on the part of any one, be diffused.

In our day of illustrated books and papers there is no telling how far the tuition of culture may extend. In this second case the art has the same inventor, but not necessarily the same executor or disseminator.

Which of these two causes has been active in any case seems to me to be a matter of counting—of numbers. The same race of people would hardly move about over the world, plant themselves here and there, and forget all the occupations and customs of fatherland excepting one or two. Mr. Tylor told the Anthropological Society of Washington that he found in the neighborhood of Philadelphia so much old-fashionedness belonging to England that he could almost imagine himself in the midst of an English village of the last century. On the other hand, the occurrence of a fac-simile of a Grecian temple, as Girard College, in Philadelphia, where other examples of Greek culture are difficult to be found, is an evidence in favor of Hellenic influence, at least upon the architect and trustees of that building.

The other motive to the adoption of the same means for the gratification of human wants or the exercise of human ingenuity, of which previous mention was made, is the identity of those wants and the instrumentalities of their gratification in all branches of the human family, including both the natural aptitudes of man himself and the material environment out of which come the resources of gratification. Upon the principle that like causes produce like effects, it is nowadays argued that men will everywhere, under the same *stress* and with the same *resources*, make the same invention. We must carefully note that different grades of civilization and different ages of the world give variable significance to the words *stress* and *resources*. In each age and in each grade, natural, primeval aptitudes are intensified and warped by inheritance and tuition. Material environment is varied and intensified by ever accumulating historical information, refinement and science. Resemblances, therefore, by independent invention become rarer, as the circles of national and racial influence enlarge and cross one another.

Before attemptling to lay down rules by which like human activities may be referred to one or another of the causes just named, the activities themselves ought to be closely scrutinized, in order that we may arrive at an intelligent definition of the word *resemblance*.

Aristotle enumerates four sorts of causes of actions: The material cause, *ex qua aliquid fit;* the formal cause, *per quam;* the efficient cause, *à quâ;* the final cause, *propter quam.* With this classification as a basis we may regard human activities and the things associated with them from several points of view, as one example will shew. The Indian basket-maker there is plying her craft. She is the efficient cause of her art. Under other social organizations it would be the men, and in higher civilization it would be one of a small guild or trade, called the basket-weavers' union.

By her side are strips of grass, splints of root or osier, bundles of cane or rattan, either dyed or in the natural color. These are the material cause of her basket.

She holds in her hand a bone, or ivory, or wooden awl or pricker; it may be also that a knife, rubbing stone and paint-brushes are at her side. These and whatever other tools she uses constitute the instrumental cause of her work.

In her mind are certain forms of baskets and of basket-weaving related to her tribal art and to the structure of the vessel; others also arise spontaneously, and the resultant of them all is the formal cause of the work.

She has her peculiar way of putting her work together, of sitting, of framing, stitching, plaiting, weaving, of placing her material into form for a fixed purpose. These constitute her manner of action, which we may call her processional or methodical cause.

Finally, the foregoing causes have been set in motion with a view to function, to the uses whereunto this basket is to be put—in a word, to the final cause. Moreover, to her art belong a technical vocabulary, all sorts of lore and myths, and even social organization and sometimes religion are influenced by it.

Now, what is true of one occupation is true of another. Each one of them, from the lowest to the highest, involves: 1, agent; 2, material; 3, implement; 4, form; 5, process; 6, motive or function; not to include others unnecessary to mention now.

Again, it must not be forgotten that the materials, implements, forms, etc., of most activities, excepting the rudest, are the products of other activities, and each may have had its six elementary causes, giving rise to generations and genealogies of causes.

Now, let it be especially noted that in each invention or art the resemblance may extend to only one of the six elements, or it may include two or more. Furthermore, resemblance may manifest itself only in some one generation in the genealogy.

If we read carefully the works of those who are constantly pointing out evidences of the migration of tribes or races, we shall see that their attention has been fixed upon only one or two elements of the art under scrutiny.

The complication of causes in producing a result stands in the same relation to the result that complexity of organization does to plants and animals. Those arts that involve the fewest causes, the shortest concatenations of causes, have the greatest chance of arising independently; while those that involve the greatest number of complicated and connected causes give the strongest evidence of absolute identity of origin.

Another consideration which we must not omit in this study is the natural relation between things and their uses; between the number of things which may perform a given function, between the number of functions which a given thing may perform. In human trades, languages, the organizations of society, the fine arts, moralities, the progress of learning, creeds and cults—the bonds of union between the ends to be attained and the number of possible ways of attaining each end vary immensely in strength and number. Admitted that all human arts whatever start from natural objects, endowments and relations, it follows that in their pristine condition men took the causes of their activity immediately from nature—flint flakes for knives; sharp sticks for spears and spades; gourds and conchs for music; ejaculations for words; consanguinity for social bond; animism for theology, and dreams for revelation. These are so natural and necessary that we need not be astonished to find men flying to them in emergencies and inventing over and over again all the devices and methods of the primeval world. If a stone knife has functions peculiar to itself, if cutting is dependent on stone knives, then the stone knife will often be invented independently. If almost any vocal combination will recall an idea; if almost any vocal combination may stand for innumerable objects, then the possibilities of associating any object with a particular vocal combination will be feebler, and similarities in language in different localities will be more likely to arise from the same people, either by migration or by literary influence. But words fly with such ease and rapidity over the earth that we are in quite as great a dilemma regarding them, whether we shall say that those who use them are of the same blood, or whether in one case they are evidence of tuition.

Since we are thus almost always the sport of three rival theories, I would prefer to adopt a new plan. Laying aside predilections I would adopt the inductive method. There must be a great many resemblances in things from different times and places about which there exists positive information.

Resemblance by independent invention being the least probable, I would scrutinize with great care such examples to ascertain the degree of complexity in the things invented, which we are allowed to suppose. It is my pleasure to bring before the society two inventions about whose independence of origin there can be no question. One is a type of basket-weaving found only at Cape Flattery, in Washington Territory, and on the Congo. The other is the throwing-stick, occurring only in Australia, Brazil and Eskimo land.

The basket weaving may be called the bird-cage type, that is, a series of horizontal rods is crossed either at right angles or diagonally by another series of vertical rods, just like the wires in a bird cage. These rods are firmly lashed in place by a continuous coil of grass or splint, making a diagonal stitch in the front and a vertical stitch in the rear. Now this process is common enough in wattling fences, fish traps, etc., but only in these two areas did men and women hit upon the notion that this stitch would make the most beautiful and effective close weaving. Wherein is the similarity in the two areas? The two forms of weaving stand thus: Alike in method or technique; different in agent (women at Cape Flattery, men on the Congo), in form, material and function.

The throwing-stick is a device for launching a dart or harpoon too heavy for a bow or in situations where a bow would be inconvenient. The Australians have no bows; the Eskimo uses his throwing-stick in the kyak, where a bow would be inconvenient, furthermore his missiles are far too heavy for a bow. Wherein do these inventions resemble? In agent, material, form and function; but not perfectly. In form they agree only in the fundamental invention, a handle and a peg or hook to catch the end of the dart or harpoon. The Australian and the Puru Puru stranded on this, their minds never conceived that it could be altered or improved. The Eskimo, on the other hand, has developed a dozen species of throwing sticks, so distinct that they can be separated by types, as follows:

The Greenland type......Hooks on the harpoon shaft.
The Ungava type........Fiddle head at the hook.
The Baffin type..........Broad and clumsy for bird spear.
The Anderson river type..Exceedingly primitive, all in one piece.
The Pt. Barrow type.....Amphora-shaped.
The Asiatic type.........Primeval in form.
The Kotzebue type.......Razor-strap form, central index cavity.
The Cape Nome type.....Pegged on the side, rude.
The Norton sound type...Climax of detail.
The Nunivak type.......Finger pegs replace cavities.
The Bristol (variety) .....A variety of Nunivah, but ruder.
The Aleut type..........Flat and wanting in detail.
The Sitkan type ....Elaborately carved.

These types are explained and illustrated in a paper about to appear in the first annual report of the National Museum.

If any one, therefore, questioned the relationship of the peoples now using this weapon, he would be allowed to compare only that of the Asiatic Eskimo, with that of the Australians. If he would regard the genealogies of causes which had led up to the simpler forms in the two regions, there would be no ground left for him to stand upon, and the case of independent invention would be clearly made out.

EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

—— The principles which underlie the doctrine of evolution are the unity of organization and the derivation of modern types of beings from a primitive germ. While the theory of descent has rehabilitated philosophy, the leading historians, such as Greene, Freeman and others, have studied and are studying history in the inductive method, and, like the evolutional naturalist or philosopher, or social scientist, go back to the beginning of things historical, detecting, for example, in the early stages of German culture the germs of our democratic system of representation and self-government.

Another set of workmen, the philologists, have long and independently, perhaps, of any influence from naturalists, adopted the methods of the palæontologists and discovered a primitive Aryan prototype of certain of our more modern as well as so-called ancient dialects; and now come the students of the world's alphabets, notably Dr. Taylor and Professor A. H. Sayce, who avowedly confess their inability to work out lasting results without having recourse to modern scientific methods, particularly the doctrine of evolution from a primitive germ.

It appears that the world's alphabets are "all but the manifest developments of a single germ." That germ was the hieroglyphics of Egypt, the running form of which was the selected characters of the Egyptian hieratics. These were adopted by the Phœnicians, who carried them to Greece. The Greek alphabet took its Hellenic shape by the addition of four new characters (φ, χ, ψ and υ), probably, Mr. Sayce claims, derived from the Hittites. Finally a great variety of alphabets belonging to different ages and localities arose, and it was "not until about 400 B. C., when the local dialects began to yield to the 'common' Greek of literary Athens, that the local alphabets also fell into disuse and were superseded by the common 'Ionic' alphabet of twenty-four letters."

Mr. Sayce farther tells us that one of the Greek alphabets, the Euboeic, "was the source of all those which were employed in Italy, * * * * and modern research has now demonstrated, to use the words of Dr. Taylor, 'that all the Italic alphabets were developed on Italian soil out of a single primitive type.'"

Using the identical words of a Darwinian botanist or zoölogist, Professor Sayce goes on to remark: "In the struggle for existence, the Latin alphabet alone survived among its Italian compeers, and was carried, by the extension of the Roman empire, through the length and breadth of western Europe. Most of our modern European alphabets are its direct offspring."

In Russia and other Slavonic countries the alphabet was of Greek origin, as were the runes of our Norse forefathers.

Professor Sayce even claims that "the immense majority, if not the whole, of the alphabets used in the East are descended, like the alphabets of the West, from the alphabet of Phœnicia. The Hebrew, Arabic and Syriac are derived from the Phœnician, the Syriac being supposed to have been 'the parent of the vertically written Mongolian and Mantchu.'"

"In fact," concludes Professor Sayce in his article on the origin of the alphabet in the *Contemporary Review* for December, 1885, "it is difficult to find any alphabet which cannot be affiliated to the Phœnician, widely different as the two may have become both in the forms of the letters and in the values they bear. Intermediate forms are continually being discovered, which bridge over the enormous distances and explain the transitions that time and space have effected. Even the Devanâgarî alphabet of Sanskrit, whatever disputes there may be as to its exact pedigree, is generally allowed to be of Phœnician origin. With the exception of the cuneiform alphabet of the ancient Persians, and possibly one or two more which may yet lurk in obscure corners of the world, all the alphabets of which we know are derived, ultimately, from a single source. Utterly diverse as they are in their latest forms, the zealous enthusiasm of palæographists and inscription-hunters has succeeded in restoring them to their earlier shapes, in filling up the intervals which separate them from each other, and in showing that they are all but the manifold developments of a single germ. The history of the alphabet, in short, like the history of its origin, is but an illustration of the doctrine of evolution on a large and easily tested scale. 'Scientific palæography,' to use again the words of Dr. Taylor, 'rests on the assumption that no alphabetic changes are ever accidental or arbitrary, as was formerly assumed, but are the result of evolution taking place in accordance with fixed laws.'"

How vividly the language and methods of work employed by these scholars recall the language and methods of the philosophic biologists in their attempts to seek the missing links and ancestral forms of life which complete and unite the chain of being!

——The bestiarians in Belgium have appropriately united with the antivaccinationists in the publication of a journal entitled The Friend of the People. In Paris and in Philadelphia the anti-vivisection societies have modified their titles so as to state that their object is to regulate, and not to abolish vivisection. To such a service reasonably executed, no one should object. However our hopes of rational conduct on their part, are somewhat abated by the addresses delivered by some of their members. It is still asserted in Philadelphia, that no benefit to physiological science has been derived from vivisection! In Paris a lady member denounces the experiments made by Pasteur in the search for the methods of attenuating animal poisons, declaring that it were better to endure rabies than tolerate the (?) cruelties inflicted on animals by Pasteur.

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RECENT LITERATURE.

COULTER'S ROCKY MOUNTAIN BOTANY.[1]—This neat manual, in its substantial binding, good paper and excellent typography, reminds one every way of the well-known Gray's Manual, of which it is, in fact, designed to be a companion volume. It is intended for use in the region lying between the 100th meridian on the east and the Great basin on the west, and extending from the northern line of New Mexico northward to the British boundary. Its range, therefore, includes Colorado, Wyoming, Montana, Western Dakota, Western Nebraska and Western Kansas.

There are several features of the book which are especially noteworthy. In it we have for the first time, so far as we are aware, an American manual of botany with the gymnosperms standing in proper relation to the angiosperms. The outline of the arrangement is as follows, viz:

Series I. PHÆNOGAMIA.
 Class I. ANGIOSPERMÆ.
  Sub-class I. Dicotyledons.
  Sub-class II. Monocotyledons.
 Class II. GYMNOSPERMÆ.

Series II. PTERIDOPHYTA.
 Class I. LYCOPODINÆ.
 Class II. FILICINÆ.
 Class III. EQUISETINÆ.

As indicating further the modern views held by the author, a

[1] *Manual of the Botany (Phænogamia and Pteridophyta) of the Rocky Mountain Region* from New Mexico to the British boundary. By JOHN M. COULTER, Ph.D., professor of botany in Wabash College and editor of the *Botanical Gazette*. Ivison, Blakeman, Taylor & Co., New York and Chicago., 1885, pp. xvi, 454, 28.

remark in the preface is worth quoting, viz: "The term 'cryptogam has been discarded as the correlative of phænogam, and 'Pteridophyta' (vascular cryptogams) is used as the name of the second great series of plants." It is gratifying to note these signs of a recognition, in a systematic manual, of the doctrine of evolution, and of the significance of the structural homologies which are now familiar to every vegetable anatomist.

We wish the author had been entirely consistent in his treatment of this part of the subject. Thus, if we consider the gymnosperms to occupy the position given them in this book, we must regard the cone (in conifers) as the homologue of the *female flower* of angiosperms, and not as an ament (*i. e.*, a spike of flowers). The so-called "spikes" of Lycopodinæ and the similar structures (male and female cones) of the conifers are so clearly homologous as not to require any discussion here; and this precludes the use of the old term "ament." In another case we notice the continued use of an antiquated term where the leaves of the Filicinæ are called "fronds." In the characters given for the class (p. 436), as well as the ordinal ones, the leaves are called leaves, with the word "frond" following in parenthesis, but in the generic and specific descriptions the old term alone is used, except in the Rhizocarpæ. We have no doubt whatever as to the author's real views upon these points, and rejoice that he has, even in part, succeeded in securing a better arrangement and a more modern nomenclature, and only regret that it was not possible to carry out in full the reform so well begun.

We find by calculations made by us that the area of the region included in this book is but little less than that included in Gray's Manual. It is interesting to notice that the number of Rocky mountain plants is wonderfully near to that of the Eastern region. Doubtless when the Western region has been as fully explored, it will have a greater number of species than the Eastern. We give below the comparisons for the different groups:

	ORDERS.		GENERA.		SPECIES.	
	Coulter.	*Gray.*	*Coulter.*	*Gray.*	*Coulter.*	*Gray.*
Polypetalæ	38	48	176	255	624	629
Gamopetalæ	23	33	181	289	683	751
Apetalæ	14	24	48	70	166	187
Dicotyledons	75	105	305	614	1473	1567
Monocotyledons	13	22	104	174	347	670
ANGIOSPERMS	88	127	409	788	1820	2237
GYMNOSPERMS	2	1	6	8	16	21
PHÆNOGAMIA	90	128	415	796	1836	2258
PTERIDOPHYTA	7	4	19	28	45	90
Total	97	132	434	824	1881	2348

Comparing the number of genera and species for half a dozen orders, the following interesting results are obtained:

	GENERA.		SPECIES.	
	Coulter.	*Gray.*	*Coulter.*	*Gray.*
Leguminosæ	20	35	143	98
Rosaceæ	26	18	65	72
Compositæ	83	85	357	288
Ericaceæ	10	28	19	67
Cyperaceæ	8	15	108	247
Gramineæ	48	66	129	168

As to the number of species common to the two regions, we have space for but a few comparisons. Taking a few of the orders as they occur at the beginning of the book, we obtain the following results, confining our comparisons to *native species* only, as in the previous cases:

	NUMBER OF SPECIES.		
	In Coulter.	*In Gray.*	*Common to both.*
Ranunculaceæ	57	54	24
Berberidaceæ	2	5	0
Nymphæaceæ	2	6	1
Papaveraceæ	2	2	0
Fumariaceæ	5	7	1
Cruciferæ	63	46	17
Capparidaceæ	7	1	1
Violaceæ	9	17	5
Polygalaceæ	3	14	1

No better argument as to the need of this book can be made than that derived from this comparison, which indicates that not more than about one-third of the Rocky Mountain species are described in Gray's Manual.—*Charles E. Bessey.*

The Catalogue of Lizards in the British Museum, new edition, Vols. I and II.—This important work, by Dr. G. A. Boulenger, fills a desideratum in zoölogy which is of long standing. Previous to the publication of these volumes Dr. Boulenger had given us in the *Ann. and Mag. Nat. Hist.*, 1884, p. 117, a synopsis of the families of existing Lacertilia, as understood by him. The classifications of Duméril and Bibron and of Gray, still generally in use, are regarded as unnatural, and the osteology and structure of the tongue as well as the presence or absence and structure of the dermal ossifications are put forward as characters of primary importance. In this respect Cope is largely but not entirely followed. Twenty families of *Lacertilia vera* are recognized, separated into three series, the first (Gecconidæ, Eublepharidæ) with smooth tongue and the clavicle dilated and loop-shaped proximally; the second without the latter character, while the third differs from the others in the scale-covered structure of the tongue. The Amphisbænidæ are regarded as a degraded type of Teiidæ, and are placed in the third subdivision, between that family and the Lacertidæ. The chameleons alone form the suborder Rhiptoglossa. The Uroplatidæ are discovered to differ from the Gecconidæ in the proximally simple clavicles and other important characters; the Scincoids of Duméril and Bibron are scattered through several families, in accordance with the views of Cope; the remaining Scincidæ corresponding to Cope's Scincidæ, Sepidæ and Acontiidæ; the Zonuridæ comprise the genera Zonurus, Platysaurus and Chamaesaura; while the Anguidæ include Cope's Anguidæ and Gerrhonotidæ. He admits Cope's family Aniellidæ, regarding it as a degraded form of Anguidæ. A family Gerrhosauridæ is established for Gerrhosaurus, which is placed near the Scincidæ; the Anelytropidæ are regarded a degraded type of the Scincidæ, and the degraded genus Dibamus is, among the scale-tongued lizards, the equivalent of the Aniellidæ in the smooth-tongued series.

Of this system it may be said that it is a great advance over any that has yet been adopted in any European country. There are, however, a good many important characters of the skeleton which have not been used by Dr. Boulenger, and which give ground for a further subdivision of the order Lacertilia. The affinities of the families cannot, in fact, be estimated without them. The form of the proötic bone is one of these, and the enclosure or non-enclosure of the olfactory lobes of the brain by the frontal bones is another. The mode of articulation of the occipital sclerotome presents important differences. Some of these characters divide his group second into groups of equal value with his groups I and III; and others indicate a greater difference between the Amphisbænians and the Teidæ than Dr. Boulenger admits. The composition of the ramus mandibuli affords important characters, so as to distinguish readily the Anolidæ and Acontiidæ, families not admitted by Boulenger.

This work is, however, the best we now have on the subject, and will give a great impetus to its study.

A second preliminary paper is devoted to the geographical distribution of the Lacertilia. He notices the parallelism, first noticed by Wagler, between the Agamidæ and Lacertidæ of the old world and the Iguanidæ and Teiidæ of the new. The Central American fauna presents a greater variety of types than South America, as it has representatives of every one of the eleven Neogean families. A review of the distribution of types in the four generally accepted zoögeographical regions of the old world leads to the conclusion that these "regions" are not supported by the Lacertilia, which range also according to longitude rather than latitude.

HARTMAN'S ANTHROPOID APES.—The author is well known as a special student of the apes, and has given us in this book perhaps the most authoritative and judicious work upon these creatures yet published. The illustrations are in nearly every case of value, and the facts are presented in a clear, simple style which adds weight to the author's views. As we see nothing to criticise, we will draw the reader's attention to some of the author's statements and conclusions.

The discussion on the ape-like characters of the lowest human tribes is of much present interest. Hartman shows that among some human races "it is impossible not to recognize a purely external and physical approximation to the simian type." Yet old specimens of apes, especially the gorilla, differ more from man than the young, and the author is strongly of the opinion "that man cannot have descended from any of the fossil species which have hitherto come to our notice, nor yet from any of the species of apes now extant." He adopts Vogt's view "that both types have been produced from a common ground-form, which is still more strongly expressed in the structure of young specimens, because the age of childhood is less advanced." Hartman adds: "This supposed progenitor of our race is necessarily completely hypothetical, and all the attempts hitherto made to construct even a doubtful representation of its characteristics are based upon the trifling play of fancy." On page 300 he remarks: "Moreover, the most fanatical advocates of the doctrine of descent are becoming ever more convinced that man cannot be the issue of any extant form of anthropoids."

Hartman in his classification of the Primates places man in the same family as the apes, man forming the type of the subfamily Erecti, and the apes, including the gibbon, in the subfamily Anthropomorpha. To place man in the same family as the apes is, we think, an extreme view, nor is the author logical in doing so, since he believes that man has not descended from any known ape, a view with which we would agree. But throughout the animal kingdom, as a rule, it is eminently probable that all the members of a family, zoölogically considered, have descended from a common ancestor. On this ground as well as from anatomical considerations, we should refer man to a distinct, special family.

KANE'S HAND-BOOK OF EUROPEAN BUTTERFLIES.[1]—A handy little book is this for the butterfly-catcher. The introduction gives the best localities and the distribution of species, methods of capture and of preservation when captured, apparatus, a full glossary of terms, arguments on seasonal dimorphism, etc. This is followed by fifteen plates and 149 pages of generic and specific descriptions. A well-chosen set of abbreviations is used, and the work is thoroughly indexed.—*L.*

[1] *A Hand-book of European Butterflies.* By W. F. DE VISMES KANE, M.A., M.R.I.A. London, Macmillan & Co., 1885.

PLATE XIV.

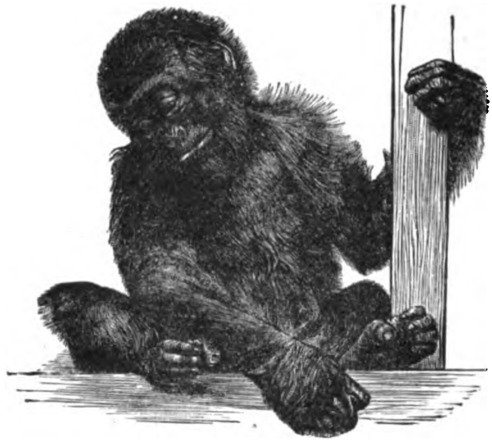

FIG. 1.—Young male Gorilla.

FIG. 2.—Same as Fig. 1, but somewhat older.

LANGILLE'S OUR BIRDS AND THEIR HAUNTS.[1]—This is an out-of-door book by an out-of-door student of birds, and bears witness to much patient observation. The faults which an evolutionist may find in it will endear it to all those who instead of believing that function precedes structure, put the latter first and make it push its own motor. It seems strange that a working naturalist should suppose that birds are supernaturally fed, and should ask "when are they starving or wanting sustenance?" as though half-starved birds are not abundant in winter, and as though none perished! The book is wordy, or as its author would probably say, one of the most remarkable characteristics of the volume is its extraordinary verbosity.

Everybody is quoted; Wilson, Audubon, Thoreau, Coues, Burrough, Wallace, Dall, Maynard are presented in long paragraphs; there are bits of many a lesser light of zoölogy, and several "distinguished taxidermists" figure in the pages.

There is a good deal of information in the book, and moral lessons and quotations are quite as prominent as ornithology. The book is handsomely printed.

OUR LIVING WORLD.[2]—This serial natural history has now been completed, parts 33–42 having been received. We have already given samples of the elegant wood-cuts which adorn the well-printed pages. The oleographs in the last numbers are excellent. The excellence of the illustrations gives the chief value to the book, which is of interest to the young rather than to the scientific student, since none of Mr. Wood's writings are above criticism. The illustrations of the insects are entirely of exotic species. Such a work as this, whatever may be its scientific defects, is worthy of wide circulation, as it leads the young to thirst for knowledge of a more exact and detailed nature.

THOMPSON'S BIBLIOGRAPHY OF PROTOZOA, ETC.[3]—A bibliography of all works and scattered articles relating to animals lower in the scale than arthropods, mollusks and echinoderms fills a long-felt need. The author modestly states that he knows there are many omissions to be discovered in his list, and begs those who use it to judge these leniently and to help him to make them good. The specialist who finds fault with these 256 pages, full of the results of hard and, to the worker, dry work, must indeed be ungracious.

[1] *Our Birds and their Haunts*, a popular treatise on the birds of Eastern North America. By Rev. J. HIBBERT LANGILLE, M.A. Boston, S. E. Cassino & Co., 1884.

[2] Published by Selmar Hess, New York. Complete in forty-two parts at fifty cents each.

[3] *A Bibliography of Protozoa, Sponges, Cœlenterata and Worms*, including Polyzoa, Brachiopoda and Tunicata, for the years 1861–1883. By D'ARCY W. THOMPSON, B.A. Cambridge University press, 1885.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

General.—Dr. T. Fischer, in Petermann's Mittheilungen, maintains that when oceanic agencies alone have formed the coasts, it consists of a succession of arcs, in the case of steep coasts with a short, and of flat coasts with a long radius. Where the coasts exhibit other features, other causes, as movements of the earth's crust, are either more powerful or are very recent.

Arctic Regions.—The Danish expedition to the east coast of Greenland returned to Copenhagen, Oct. 2d, after an absence of nearly three years. Besides the collection of valuable scientific material, Lieut. Hahn has made some important geographical and ethnographical discoveries. He wintered between latitudes 65° and 66° and reached 66.08° N., the highest point yet visited by Europeans on the coast. He has named the stretch of coast explored Christian IX's land.

The area of Store Baergefjeld, in Arctic Norway, has been represented as an immense glacier field. The observations of Chas. Rabot show that there are nearly seven secondary glaciers, hardly passing beyond the stage of *névé*, and that their total area does not exceed six kilometers. The region is not a plateau, but to the north a mountain mass with summits nearly 6000 feet high, and averaging 3600 feet; and to the south a densely wooded table-land cut up by cañon-like valleys. Rabot has also found that three distinct chains of mountains, reaching a height of more than 3000 feet, exist in the Kola peninsula, between the White sea and Arctic ocean. The district is usually shown as a plain, broken

[1] This department is edited by W. N. Lockington, Philadelphia.

merely by lakes and low hills. Between the ranges the land is level, and trees of good size reach 63° 50′ N. lat.

AFRICA.—*The Resources of Africa.*—A pamphlet by Dr. A. Fischer, entitled "*Mehr Licht im dunkeln Weltteil,*" is interesting as giving the most unfavorable view possible of the resources of Africa, and may be useful to those who have been too much carried away by the enthusiastic reports of travelers.

Dr. Fischer gives the total exports and imports of Zanzibar at £1,750,000, and the total value of the exports of the west coast at £2,450,000. The total annual yield of ivory he estimates at £800,000 in value, and 1,760,000 lbs. in weight. This trade, which with great truth Dr. Fischer regards a curse to Africa, since it diverts the energies of both natives and traders from agriculture, costs the lives of 40,000 elephants annually. The elephant is almost exterminated along the coast over a width of 130 to 200 miles, and is no longer to be found in South Africa. Caoutchouc in East Africa is being rapidly exterminated by the unskillful and improvident way in which the juice is collected. Gum copal, since competition with Australia, has so sunk in price as not to pay unless with slave labor. Dr. Fischer takes also a desponding view of the agricultural capabilities of Africa. On the whole, however, his statistics prove rather the need for settled government and economical exploitation of resources than any unfitness of African soil for colonization or production. Statistics show that the trade of Africa is growing, and coffee, which he maintains cannot be profitably cultivated without slave labor, is a success in Liberia.

Lieut. Wissman's Expedition.—Lieut. Wissman's expedition down the Kassai throws new light on the geography of the Congo basin. The Sankuru, or lower course of the Lubilash, unites with it by two arms 830 and 1000 feet wide; a river which Lieut. Wissman believes to be the Loangwe, though at its mouth it is known as the Temba, flows in lower down; and still lower the great Cuango and the Mfini from Lake Leopold unite their waters with it. Below the Sankuru the Kassai is 3300 yards wide, and lower down, before receiving the Cuango, it spreads out to 10,000 yards or more, and is dotted with islands and sand banks. Its lower portion, known as the Kwa, is narrow, not more than 450 yards, but deep and rapid. The Ruembé, Chibumbo, Luachim, and Chikapa are affluents of the Kassai. Luluaburg is a station established by Wissman on the Lulua, some distance above its confluence with the Kassai. The river voyage commenced at Lubuku, the residence of Mukenge. Below the confluence of the Lulua the native name is Savié. The natives here are Barkuba on the right bank, Bashilelé on the left. Lower down, below he Sankuru, reside the Badinga and Bangodi, and still lower the Btakuta, who were hostile to the explorers, and are reputed cannibals. Still nearer the junction of the Cuango are the Baduna.

African News.—The native population of the Gaboon region is, according to Dr. Lenz, being rapidly driven towards the interior by the Fans. The Germans have annexed the country lying behind the French possessions at Great and Little Popo, on the Gold coast.——M. G. Angelvy, a French engineer in the service of the Sultan of Zanzibar, reports that he has discovered coal of excellent quality on the Lujenda tributary of the Rovuma. The great drawback is the distance from the coast, all the more to be regretted since beds of siderite lie near. The Rovuma, though 2000 feet wide, is but a foot to a foot and a half deep. The sultan intends to work the coal-beds, and to construct a road or railway to Lake Nyassa. Sir John Kirk, in a letter accompanying that of M. Angelvy, states that the coal region lies sixty miles south of the latitude of Delgado bay, and a question of inland frontier is therefore likely to arise between the Sultan of Zanzibar and Portugal.——At Tunis a modern French town is being built between the native city and the lake. Land is being rapidly brought under cultivation, taxes reduced, roads constructed, and the country in every way improved.——M. Moller has proved that the peak of St. Thomas is the highest land in the island of that name, and is 2142 meters high.——The November *Bulletin della Società Geographica Italiana* contains a letter from De Brazza, describing a voyage undertaken from Brazzaville to the Licona or Ncunda. The name Congo is not known by the Apfurus and Bateke, who speak of it as the Great river. The village of Bonga at the mouth of the Alima is large and picturesque, it is intersected in all directions by canals, and the houses, some fifty meters long, form streets. Down the wilderness of canals is brought the large quantity of manioc grown upon the Alima, for the supply of the natives of the Congo banks, which in this part are unfitted for the growth of manioc. De Brazza says that it will be half a century before the labyrinth formed by the various channels of the Congo above Stanley pool is correctly mapped. For eight days, he says, "we believed we were on another river, and found after all that we were on the Congo." The Apfurus and Bayansi are the same people.——H. Entz and A. Mer have, after a careful study of the voyage of Hanno, the Carthaginian, come to the conclusion that it terminated at Fernando Po. Thymaterion is identified with the town of Mazaghan, and the promontory of Soloé with Cape Cantin. The Lixus is by Mer identified with the Senegal, by Entz and others with the Draa. The island of Cerné is probably Goree and the Western Horn answers to the Bight of Benin.——Sister Cipriani, one of the prisoners taken by the Mahdi, now freed through the endeavors of M. Sagaro, states that Khartoum is almost deserted, but that Omdurman is now populous and has become a second Mecca, the Arabs coming from all parts to the Mahdi's tomb, which is a day's journey from the place. Lupton Bey, Slatin, the commercial traveler Cuzzi, and two

Frenchmen, one a journalist, are prisoners with the Caliph Abdullah at Omdurman.——The German government has published the annexation of the territory called Usaramo in west equatorial Africa; and has occupied Dar-es-Salam, a port opposite to Zanzibar.——The King of Dahomey has abolished human sacrifices in virtue of a treaty entered into between him and the Portuguese governor of San Principe, and a Portuguese protectorate is by the same treaty established over the sea-coast of Dahomey.

ASIA.—*Southern India.*—From some notes by Col. B. R. Branfill, it appears that *Ghat* means a pass and that monsoon is derived from the Arabic *mausim*, which means season. The south-west monsoon, which blows from May to September, is supposed to be the great sea-breeze produced by the rarefaction of the air in the drier parts of Asia, while the north-east monsoon is the ordinary trade-wind. March, April and May are the hot season of Southern India, the north-east monsoon succeeding it. The south-west monsoon parts with its moisture on the Malabar coast, and gets warmer and drier as it blows over the table-land of Mysore. The north-east monsoon fills the rivers and tanks of the drier Carnatic plain to the east of the ghats. The ghats are not very high, and when viewed from the table-land enclosed by them, seem rather a battlemented parapet than a range. A leading feature of the western ghats is a long easy slope, crested with forest, leading up to a cliff overlooking the coast-plain. Such a cliff-summit is called a *Kadure-Mukh* or horse-head. The eastern ghats have no such well-marked line of precipices as the western. Most of the drainage of Mysore, which undulates from two to three thousand feet above the sea, is to the eastward. The larger rivers have deep and rocky channels, but the smaller are converted into series of reservoirs until there is no room for more dams. There are nearly 40,000 such tanks in Mysore, the largest some twenty miles around. The River Cauvery is thus utilized throughout the province. On it are situated the former capital, Seringapatam or Srirangapatnam, which is now deserted, and is a pestilential wilderness, and the ruins of the more ancient capital of Talkad, now buried in sand save only the pinnacles of the temples. In the Wainad or open country of the western highlands, south of Coorg, gold-mining has been commenced, and there are many traces of ancient workings. S. S. E. of the Wainad lies the nearly isolated plateau of the Nilgiri hills or Blue mountains, rising on the western edge to 8000 feet or more, while Dodabetta, a conoidal mass with steep slopes covered with grass and woods, rises from its center to a height of 8640 feet. These hills are the home of the Todas. The Nilgiri hills, though separated from the main table-land of Central India by the Moyär ravine, form really its southern termination. South of them is the Palghät gap, leading from Malabar to the south-central lowlands of Coimbatore and Salem. South of the gap the mountains rise again as the Anamalai or Elephant hills, and farther south, the Travancore hills. These are a true mountain range, rising directly on all sides from the lowlands, and are steepest on their eastern slopes. The highest measured point, Anamudi or Elephant's brow, is 8840 feet above the sea, and the loftiest known peak in Southern India. This range, called also the Southern ghats, ends at Cape Comorin. To the east of the Anamalai hills lies the lofty plateau of the Palani hills, in two steps, the upper 7000 feet high. Groups of similar but minor masses of hills are met with at intervals eastwards and northwards, surrounding the lowlands of Coimbatore and Salem, perhaps once the seat of a former inland sea. South of the Palanis is a large tract of mountainous wilderness, occupied only by wild animals and wild men of the lowest types, who go unclothed, and feed on such fruits and roots as they can scratch up with their fingers. They can make a fire, but seldom do so, and gather cardamoms, honey and other wild produce to exchange with their more civilized neighbors for salt, grain, and a little cloth to adorn their women. There are no harbors worthy of the name on the usually low Malabar coast, but a chain of lagoons affords inland communication for several hundred miles. Cape Comorin is a low rocky promontory. Once there was a harbor, town, and pearl market, but now nothing is left but the temple of Kanyâ Kumâri, the "Virgin Maid," still a resort for devout Hindus. Korkai, the Kolchoi of Greek geographers, an emporium 2000 years ago, is now three miles inland, its successor Kâyal (the lagoon), mentioned by Marco Polo, is now deserted by the sea, and the present port of Tuticorin promises to be in turn silted up. All the rivers of Southern India tend to shift their mouths northwards from the action of the ocean rollers. The Coromandel coast is marked by a line of sand-hills with lagoons here and there on the landward side, and there seems to be an advanced line of coast in course of formation several miles out to sea. There is much coral in the Gulf of Manar. Besides the changes occurring on this coast from constant causes, storm waves have destroyed many ancient cities and ports.

Asiatic News.—A ruined city, hitherto unknown, has been found in Adana, Asia Minor, not far from Tarsus, near the route from Sélef-Ké to Karaman. Sarcophagi like those of Lycia exist almost intact.——Residents of Siberia are organizing an exploration to investigate for five years the ethnology and social economy of that vast region. Young men will be distributed over the country for that purpose. A railway from Ekaterinburg to Kamishoff is completed; and the canal between the Obi and Yenisei will probably be ready for navigation at the latest in the spring of 1887. Sibiriakoff has established a line of steamers on the Angara, between Lake Baikal and the Yenisei.——M. Daniloff believes that he has found the point of bifurcation of the Oxus into the Amu Daria and the Uzboi or Unguz.——A recent French writer describes the route from Lao-Kai on the Red river of Tonquin, to Mengtsze in Yunnan. He is not enthusiastic about any of the routes from Tonquin, though he thinks France has as much chance of getting the China trade as any of her rivals. The route from Lao-Kai to Manhao is by river, but from the head of navigation to the plateau of Yunnan the coast is extremely difficult and mountainous.——Commander Réveilliere has succeeded in passing the rapids of the Meikong, beyond Samboc, the chief Cambodian town on the river, in a steamer. These rapids are at present a bar to navigation, but M. Réveilliere is convinced that it is formed of nothing more than a mass of trees permanently freed and added to every year. The town of Strung-Treng where most of the commerce of the Laos reaches the river, is above the rapids.

GEOLOGY AND PALÆONTOLOGY.

THE ENGLISH CRETACEOUS.—With the Cretaceous, or rather with that indefinite age which intervened between the close of the Cretaceous and the dawn of the Eocene, unrepresented by any stratified rock in England, we close the book on the evolution of Gymnosperms for nearly all the archaic anomalous genera which held the place of our larches, pines and spruces, cypresses and junipers, had given way to living genera and even species.

It is a remarkable fact that the extermination of so much that was preëxisting of both the marine and terrestrial fauna, embracing nearly all the armoured cephalopods and the gigantic saurians which had till then occupied the foremost place, should have been accompanied by a similar wholesale disappearance among plants. To suppose that this period was an exceptionally fatal one, annihilating entire orders of the animal kingdom, is to admit, in the complete absence of evidence, a break or jerk in the majestic progress of life upon the earth which is repugnant to common sense; and it is more consonant with our present views to suppose that we are in presence of one of those vast gaps in the geological record which we know must have occurred over and over again in every area upheaved upon which sedimentary rocks had been deposited. In turning from the last Cretaceous deposit in Europe, we seem, so far as the plant world is concerned, to finally break with the past, while the first deposit of the Eocene appears like turning over the first page of the history of things as we see them now. It is thus, perhaps, worth our while to turn aside for a moment to take stock as it were of the closing events of the Cretaceous, so far as we know them at present, in order to estimate the true nature of the apparently sudden bound in the usually stately unarmed progress of evolution.

It appears that during the chalk formation a great wave of depression passed across Europe, traveling from the West to the East, permitting the ingress of the Atlantic, and forming a gulf over what is now Central Europe, which constantly increased in magnitude. We need not believe that this gulf was formed by any sudden catastrophe, for there is no reason to doubt that the sea conquered the land by the same methods and at somewhere about the same rate that it encroaches now, and that therefore its advance over many thousands of square miles of *terra firma* would be an exceedingly lengthened process. We cannot gauge the time this occupied, but we know that since the appearance of man Southampton water has been formed, and a tract between Alum bay and Studland, some fifteen miles long and five or six miles broad, has been swept into the sea, and several species like the mammoth have become extinct. The rate of the encroachment depends mainly on that of the subsidence and the original height of the land, but what has here been effected in a subsidiary area serves to show roughly how vast a time must have been needed for the chalk sea to have crept from Kent to the Crimea, and covered the enormous area of Europe over which its traces still remain. As the land subsided and became sea, blue and green muds were thrown down, to be succeeded in due course by the deeper deposits of chalk ooze. It would be physically impossible for chalk, supposing it to represent globigerina ooze,[1] to be

[1] True chalk is a pure white limestone, composed of the remains of Foraminifera, valves of Cytherina, excessively minute infusoria, cell prisms of Inocerami, sponge spicules, and other debris of organic life. It was, until recently, universally admitted to be a truly oceanic deposit, of similar nature to globigerina ooze, but Mr. Wallace, supported by the late Dr. George Jeffreys, has lately put forward the view that it was formed in shallow water. Its vast extent, homogeneous nature, and freedom from terrestrial impurity show that it must have been formed remote from land, while its larger organisms, mainly Echinodermata or sponges, are with some exceptions, such as are now met with in abyssal depths. Mr. Wallace laid some stress on the difference in composition of fresh globigerina ooze and chalk, as shown by analysis; but Mr. Murray has recently stated that the percentage of carbonate of lime varies from 40 to 95 in the ooze. The comparison took no account of the fact that the chalk had been elevated for ages, during which it has been ceaselessly removing some of its original constituents. Silica has been dissolved and re-precipitated as flint, its iron has been segregated into crystalline masses, its manganese into dendritic markings, siliceous sponge skeletons have been dissolved and replaced by calcite, calcite shells by silica, and aragonite shells removed entirely. Layers of chalk a foot in thickness have been reduced to an inch by the removal of lime in solution. The late Dr. George Jeffreys had not studied the chalk, and based his conclusion upon the mollusca only, and these chiefly of the chalk-marl, and seemed unaware that only the calcite shells remained in true chalk. Of these Terebratula, Pecten, Amussium, Lima, and Spondylus are the chief genera still existing, and all but the last are already known to inhabit water 1400 fathoms in depth. Moreover, if the chalk sea did not communicate with the Arctic ocean, as Prof. Prestwich and others believe, and was shut off from the Antarctic by land between Africa and South America, as there is also much evidence to support, its abyssal depths would have been warm instead of icy cold, and its former abyssal inhabitants, accustomed to warmth, would have sought shallower water now in order to find an equal temperature, and become, as George Jeffreys states them to be, a tropical assemblage. The blue and green muds of the *Challenger* pass into globigerina ooze with an increased depth, and their equivalents of Gault and greensand pass into chalk in exactly the same way. The alternative theory of Wallace, that chalk is decomposed coral mud, could not have been advanced by a geologist, as, while the chalk contains some well-preserved solitary corals, not a reef-building coral has ever been met with either in or surrounding it, nor even in any contemporaneous deposit.

directly formed on a former land surface, and we consequently find that it is invariably preceded by some more littoral quality of sediment. The nearer the original centre of depression or focus of subsidence, the older the green sands and Gaults must necessarily be; and the farther we recede from it in any landward direction the newer they will be. Now, apart from physical evidence, a comparison of the faunas of our chalk with those of any European bed correlated with it to the eastward would at once show that if one was older than another, it would be that of our area. Forms like Mosasaurus, which only appear in our very latest chalk deposits, abound in Cretaceous deposits of more central Europe; whilst others, such as Ichthyosaurus, found abundantly in our chalk marl, are, on the contrary, absent. The rapid increase in the development and proportion of long canaled and other Eocene-looking gastropods, culminating in the Danish Upper Chalk, indicates most conclusively a more and more recent period of deposition for the beds in which they occur. The littoral zone must in fact have been constantly traveling outward and forward, and accumulating only until the ever-increasing depth led to a change in the sediment. Thus, though beds of green sand or chalk may be perfectly continuous, with precisely the same lithological characters, it is absurd to assert that portions of it, when separated from each other by degrees of latitude and longitude, must be synchronous. So far from this, the chalk with flints of one locality must most certainly have been deposited synchronously with the chalk of another, and this in turn with the chloritic marl of another, and the greensand of another. The shallower water zones, such as the greensand, would travel forward so long as the sea continued to encroach, and along the farthest confines of the gulf would recede again when elevation set in without any chalk being deposited over them, so that some upper greensands might be newer than any chalk. It is probable that each minor zone was a zone of depth, characterised by the same quality of sediment, and a fauna to some extent peculiar to it, and which kept up with it as it traveled farther and farther landwards. There would thus be great similarity in the fauna of each zone at any interval of distance, and it might maintain its distinct charcteristics over the most extensive areas, without, for all that, its contents having lived synchronously over the whole area.

We have noticed that the Neocomian and Gault of England and Western France contain a varied and considerable flora, represented mainly by foliage and fruits of Coniferæ, without affording the slightest trace of the presence of angiospermous dicotyledons. Even the Gray Chalk and the Blackdown beds have only yielded conifers and a Williamsonia of Jurassic type. We cannot account for their absence by supposing our area to have been isolated, for in the preceding Wealden period neither its fauna or flora differed from that of Europe. But when we reach Aix-la-Chapelle, we find the chalk and greensand resting upon beds containing a flora largely made up of dicotyledons, and still farther off, in the Cenomania of Bohemia, living genera such as Magnolia, and farther on still, equally developed dicotyledons in the supposed yet older Turanian. Such facts were hitherto completely inexplicable, but it now appears even probable that the interval required for the chalk to progress only 300 or 400 miles endured long enough to have permitted an enormous progress in the evolution of phanerogams. Nor does the 1200 or 1400 feet of vertical chalk remaining in our area at all represent the completed formation; for, as the prolonged subsidence finally ceased and gave place to an equally slow elevation, all the lessening zones of depth would travel back with the receding ocean, and leave a series of zones inversely arranged to that preserved to us. The planing action of the sea has removed all this newer series, just as it has planed away a further mass of the width of the English channel, and is slowly but inexorably cutting down to its own level all the zones that form its shore lines. The Eocene seas from beginning to end of the period were ceaselessly engaged in this work, and their enormous deposits of flint shingle mark how much of the chalk had fallen a prey to them. Nor has the chalk enjoyed any respite from the work of destruction down to the present day, so that what now remains is a mere fragment of what once existed. It was during the interval that elapsed between the formation of the newest chalk now left in England and the oldest Eocene that dicotyledons were introduced, and our existing flora practically came into existence. All the Upper Cretaceous floras of Europe also flourished during this interval, but we cannot say, with our imperfect record, exactly the order in which they came in, and must be content to regard them in a general way as far newer than they appear to be stratigraphically. The entire American Cretaceous series should, perhaps, also be placed somewhere in this interval, though those well qualified to judge regard its commencement as dating from an older period. Without this digression we could not have formed an adequate idea of the meaning of the "Cretaceous period" and so realized that the so-called Cenomanian and Turanian floras of Europe may belong to a completely different epoch to that represented by the same horizons in Kent and Sussex.—*J. S. Gardner.*

ON PROSCORPIUS OSBORNEI WHITFIELD.—In an article with the title: "On a fossil scorpion from the Silurian rocks of America."[1] Mr. Whitfield has recently published a description and figures of a highly interesting animal, the *Proscorpius osborni* Whitf., which he had some time before made known to zoölogists, in a prelimi-

[1] In Bulletin of the American Museum of Natural History, Vol. 1, No. 6, p. 181 (October 10, 1885).

nary notice: "An American Silurian Scorpion,"[1] under the name of *Palæophonus osborni*. The animal is no doubt a real scorpion, and not an Eurypterid; but as a few of the characteristics ascribed to it by the author would seem to remove it very far from other scorpions and especially from the Palæophonoidæ, to which it appears to me to be closely related, I venture to offer a few observations on this arachnid, or rather, on Mr. Whitfield's interpretation of certain points in its organization. Of course I give no other weight than that of mere suppositions to the opinions I am going to express, being fully aware of the difficulty and perhaps rashness of offering criticisms on the description of a rather badly preserved fossil, without knowing the "corpus delicti" from actual inspection.

According to Mr. Whitfield, the abdomen (preabdomen) of his scorpion is provided with *six* long and broad ventral plates, and if this were true, this animal would of course be so different from the rest of the order, that it ought perhaps to be considered as the type of a group equivalent to all the other known scorpions taken together; for in all other scorpions there are only *five* such plates, the sixth (reckoned from behind) being reduced to a small sternite, situated between the bases of the pectinal combs. Such a form of the said ventral plate as described by Mr. Whitfield, would no doubt, as he himself aptly remarks, imply great modifications in the position and shape of the pectoral combs of the animal, and probably also in the structure of the whole inferior part of the body in front of the plate in question. But to me it does not seem necessary to admit that Proscorpius differs in so high a degree from other known scorpions. I strongly suspect, that *all* that is seen of the abdomen in Mr. Whitfield's specimen (with the exception only of the narrow border to the left, and, perhaps the posterior part of the equally narrow right-hand border) is formed *exclusively of the dorsal plates*. The whole upper side of the abdomen is broken or cracked longitudinally; the narrower, right-hand part, considered by Mr. Whitfield to be formed of the inside of the *ventral* plates, has perhaps an appearance different from that of the rest of the upper surface, only from having been more strongly depressed and crushed, and the apparently slightly greater lengths (in the antero-posterior direction) of the right-hand parts of the plates would seem to depend on the same cause. This interpretation easily accounts for the circumstance that in Mr. Whitfield's specimen the articulations between *all* the "ventral" plates (not only between the posterior ones) are *direct continuations* of the articulations between the "dorsal" plates, which is not the case in other, at least not in recent, scorpions. In these, in fact, the articulations between the first two or three dorsal plates do not correspond to or are continued by articulations on

[1] In Science, Vol. VII, p. 87 (July 31, 1885).

the ventral side of the body; for in these and perhaps in all scorpions, the dorsal plates increase in length, counting from front backward, so that the first plate is the *shortest* of all; whereas (at least in recent scorpions) the first *ventral* plate is *longer* than the following ones, corresponding in length and position to *two* or even *three* (2d and 3d, or 1st–3d) dorsal plates taken together.[1] If the above given interpretation is, as I believe, the right one, the want of *spiracula* on the plates needs no further explanation.[2]

Mr. Whitfield thinks that, whereas modern scorpions carry the tail (postabdomen) arched upward over the back, Proscorpius, and also Palæophonus, carried it in the opposite way, or curved *downward*. This would indeed be a character of fundamental importance in distinguishing the Silurian scorpions from all other members of the group; but to me it is impossible to find any stringent reason for adopting this strange hypothesis. In the first place, it would seem that the animal's gait would become exceedingly difficult and awkward, if it were to walk with its tail curved under the body; and when it wished to kill, with the sting, the prey which it had caught with the hands of the palpi, it would probably be obliged to thrust the palpus with the prey between its legs, under the body, in order to bring it within the reach of the sting—no doubt a difficult performance for the animal. That in the embryo of scorpions the tail is bent under the body, is of course no reason for believing that the tail retains that position after birth, in the earliest or Silurian species, rather than in Carboniferous and recent ones. As to Palæophonus, I do not entertain the least doubt of its having carried its tail in the same direction as living scorpions. It must be borne in mind that, when a scorpion is strongly depressed or flattened, the tail, on account of its being arched upwards and not allowing of being stretched out in a straight line backwards, cannot well turn the dorsal part of more than its *basal* joints upwards; the following joints become gradually more and more turned to one side or the other, so that the last joint or joints will be seen in profile, or even obliquely from below. Such is the case in the specimen of *Palæophonus nuncius* described and figured by Professor Lindström and myself.[3] The basal joints of the tail of this animal are destroyed but must have turned their upper or dorsal surface upwards, as they have left the impression of their ventral part on

[1] In a specimen of *Buthus 5-striatus* Hempr. et Ehr., for instance, whose abdomen (preabdomen) is $24\frac{1}{3}^{mm}$ long, the length of the first ventral plate is 6^{mm}, that of the first three dorsal plates taken together $5\frac{1}{2}^{mm}$.

[2] Even if the plates in question really were ventral plates, the first (or sixth, when counted from behind forward) would from its position seem to correspond to the anterior half of the first ventral plate in ordinary scorpions, and *not* to the small plate situated between the pectoral combs. The genital plate is, I believe, the sternite of the first *segment* of the abdomen, quite as the plate between the combs is the sternite of its second segment.

[3] Thorell and Lindström, on a Silurian scorpion from Scotland (K. Svenska Vetenskaps-Akademien Handlingar, Bd. 21, No. 9).

the stone; the next following joints are seen from the left side, the two last obliquely from that side and from below. In the Scotch Palæophonus described by Mr. Peach,[1] which is turned upside down, we consequently see that the basal joints of the tail turn their ventral part upward and that the last joints are viewed *obliquely from above.* As to Proscorpius the impression one receives from the figures is, that the tail shows the *dorsal* surface of at least three of the four joints still preserved, just as would be expected. Mr. Whitfield says, however, that it shows, *not* the upper or dorsal surface, but "the inside of the *ventral* or lower plates of the four anterior segments;" and as these plates have the same form and sculpture as the *dorsal* plates or parts of these segments or joints in ordinary scorpions, he concludes that in Proscorpius "the bending of the tail would be downward, and not over the back, as in more recent and living scorpions." Now it seems utterly improbable to me that *Palæophonus nuncius* and *Proscorpius osbornei*, which both belong to the Silurian age and which are in many respects closely related, should differ from each other in so important a particular as the direction of the tail. Perhaps it is not impossible that Mr. Whitfield is mistaken in referring what remains of the tail in his Proscorpius to the *ventral* part of the joints. But even if he is right in this, the fact can easily be explained, if we admit that the tail which, according to Mr. Whitfield himself, is *detached* from the body, or to use his own expression, "slightly displaced in relation to the last segment of the preabdomen," has also become *turned upside down;* in that case the joints of the tail would, when their ventral upturned surface had been destroyed, show the inside of their dorsal surface in precisely that position which Mr. Whitfield attributes to the ventral surface of the joint. That Proscorpius had its tail curved downward is, therefore, by no means proved by Mr. Whitfield's specimen.

As the walking limbs of *Proscorpius osbornei* are in a very bad state of preservation, it is no doubt difficult to decide with certainty whether this animal belongs to the ordinary two-clawed scorpions (Dionychopodes) or to the Apoxypodes, or those Silurian forms which have the tarsi pointed and clawless, or possibly armed with a single claw. Only one of the legs, the left one of the first pair, is, according to Mr. Whitfield, undamaged, and provided at the tip with *two* claws. This assertion, if right, would of course settle the question at once; but a close inspection of the figures of the animal makes me believe that that leg also is incomplete, being broken near the base of one—probably the last—of the joints.[2] The "bifid" ending of the leg on the figures does, in fact, not at all give me the impression of two claws, but resembles closely the also broken end of the right leg of the last pair in the figure of

[1] Ancient air-breathers, in *Nature*, Vol. XXI, No. 796, p. 297. Jan. 29, 1885.
[2] So it appears at least on pl. 20, fig. 1, in Mr. Whitfield's paper.

Palæophonus nuncius Thor. & Lindstr.[1] The joint was perhaps armed with a strong spine near the base (as is the case with the fifth joint in *Palæophonus nuncius*); at all events, the two joints have no resemblance to the claws of ordinary scorpions. But besides this, there are several other reasons for doubting that Proscorpius belongs to the Dionychopodes. In Palæophonus all the joints with the exception of the last, are *cylindrical* or nearly so; in other scorpions the *tibia* is compressed and *convex longitudinally* on the under side; and in this respect Proscorpius appears to have resembled Palæophonus and not the Dionychopodes. The tolerably well-preserved leg of the first pair of Proscorpius seems to show that most of the joints of the legs have been comparatively *short* in this animal, and in this particular also it resembles Palæophonus and differs from the Dionychopodes. The "crowding forward of the limbs and appendages" depends on the *shortness of the posterior coxæ*, and is a characteristic that distinguishes Proscorpius from the Dionychopodes, but not from Palæophonus. (It is not probable that Proscorpius differed from other scorpions in the number of the joints of the legs; if we assume that in the best preserved leg of Mr. Whitfield's specimen the first joint or coxa is concealed by the margin of the cephalothorax, and that the leg is broken at the base of the last joint, it would seem to consist of seven joints, quite as in all other scorpions.)

Another character, by which Proscorpius appears to be more nearly related to Palæophonus than to other, at least recent, scorpions, consists in *the transverse furrow*, which extends across the cephalothorax, so that its posterior part forms "a broad band, resembling a segment of the preabdomen." *The small size of the dorsal eyes* would seem to be a character, in which Proscorpius differs from the Eoscorpioidæ, to which it is referred by Mr. Whitfield; in this particular it resembles rather Dr. Hunter's and Mr. Peach's Scotch Palæophonus, being, as Mr. Whitfield justly remarks, also in its general aspect more like this scorpion than the probably eyeless Swedish species (*P. nuncius*). But though I believe that Proscorpius is nearly related to Palæophonus, it forms no doubt a good peculiar genus, characterized by the somewhat trilobed anterior margin of the cephalothorax, and more especially by the shape of the fingers of the *mandibles*, which, if they really had such a form in the living animal, as from Mr. Whitfield's figures they appear to have, differ materially from those of Palæophonus and all other known scorpions.

It will be seen from the foregoing lines, that I cannot find that Proscorpius differs essentially from the hitherto known scorpions in other respects than in the somewhat *shorter cephalothorax*, and *perhaps*, in the form of the *mandibles*. Its systematical position appears to me to be in the close vicinity of Palæophonus, and

[1] Thorell and Lindström, loc. cit., fig. 1.

especially of the Scotch scorpion referred to that genus by Mr. Peach. An additional reason to those given above for removing Proscorpius from the Carboniferous Eoscorpioidæ, and for referring this genus to the Apoxypodes, fam. Palæophonoidæ, may be found in its being, geologically speaking, almost contemporary with the Palæophoni, belonging, like these, to the Upper Silurian formation. As the Palæophoni, and all other more recent scorpions, are undoubted land-animals and air-breathers, and, as no traces of branchiæ have been shown to exist in Proscorpius, there is, I believe, no serious reason for considering that this scorpion is an aquatic animal, or that "we have here a link between the true aquatic forms, the Eurypterus and Pterygotus, and the true air-breathing scorpions of subsequent periods," as Mr. Whitfield supposes. Very strange, also, would it be, if the connecting link between the gigantic Eurypterids and the scorpions should be formed of such a little creature as *Proscorpius osbornei*, one of the smallest scorpions hitherto known—especially as this diminutive scorpion lived contemporaneously with the Eurypterids.—*T. Thorell, Sori, Italy.*

AN EXTINCT DOG.—The remains of an extinct type of dog, differing widely from any of the ordinary wild or domestic dogs, have been recently described by Mr. J. A. Allen in the memoirs of the museum of zoölogy at Harvard college. The bones were found in Ely cave, Lee county, Virginia, one of the oldest of a group of caverns in limestone of Cambro-Silurian age described by Professor Shaler, of the geological survey of Kentucky. In general form the new dog was a short-limbed, heavy-bodied animal, resembling in its proportions a badger rather than a dog. The skull has not been found. Mr. Allen refers the remains to a new genus, under the name of *Pachycyon robustus.*

MINERALOGY AND PETROGRAPHY.[1]

TIN.—In the "Mineral Resources of the United States, calendar years 1883 and 1884,"[2] W. P. Blake describes the occurrence of "tin-stone," two miles from Harney city, in the Black hills, Dakota. This locality was discovered in June, 1883. During the following year a company was formed to mine the ore, and enough progress was made to show that the find was commercially of much importance. The ore is found in two distinct forms, viz: massive, in bunches with spodumene, feldspar and quartz; and granular, disseminated in greisen.[3] The principal vein, known as the Etta, is described as having a rudely concentric structure. The outer portion consists of a mixture of dark and light colored

[1] Edited by W. S. BAYLEY, Johns Hopkins University, Baltimore, Md.

[2] Washington, Government Printing Office, 1885.

[3] A rock with the microscopic characteristics of ordinary greisen, but containing albite instead of quartz.

micas, within which is a second belt of quartz and spodumene. Associated with the latter is the cassiterite in bunches, some weighing as much as fifty or sixty pounds. Inside of this second belt is a third made up of greisen, in which occurs the granular variety of the ore. The central portion within the third belt is principally a coarse mixture of quartz and feldspar. The spodumene crystals in the second belt are of enormous size. One of the largest, measuring thirty-six feet in length, is without a single flaw. The area of the tin-producing region is being constantly extended by new explorations, so that its limits cannot yet be definitely fixed. In addition to its occurrence in the rocks the mineral is also known to exist as "stream tin" in the water courses leading down from the hills into the surrounding plains.

Petrographical News.—*Peridotites.*—The rocks of this class belonging to the "Cortlandt series" on the Hudson river near Peekskill, N. Y., are divided by Dr. G. H. Williams[1] into hornblende peridotites (Hudsonites of Cohen), and augite peridotites (picrites of Tschermak). The former are characterized by the structure so well seen in the case of "Bastite" or "Schillerspath," and called by Pumpelly and Irving, "luster-mottling." In the present instance this structure (for which the author proposes the word *poicilitic*) is due to the inclusion of olivine, or its alteration product serpentine, in hornblende. This hornblende is without crystal form and is filled with sharp little transparent crystals and opaque black needles. These latter occur also in the olivine and are identical with those which Judd[2] considers as of secondary origin. This view the author of the present paper combats. He thinks they are substances extruded during crystallization as incapable of forming a part of their host, like the silicates in metamorphosed limestones. The hornblende peridotites pass, by the assumption of diallage, into the augite variety. Occasionally these become schistose as the result of the action of great pressure. Colorless augite with diallage-parting, hypersthene, brown hornblende and well defined crystals of olivine are the most important constituents of this rock.——*Variolitic granite.*—The first notice of variolitic granite from Craftsbury, Vermont, appeared in Hitchcock's report on the geology of Vermont.[3] The author there described it as a fine-grained, white and highly feldspathic granite, with considerable black mica. Scattered through this base occur numerous spheroidal nodules of black mica, more or less flattened. This peculiar variety is only locally developed, the granite between Stanstead and Craftsbury, exhibiting no unusual appearance. It occurs most abundantly just south of the latter town. Recently it has been subjected to microscopical examina-

[1] American Jour. Science, v. XXXI, Jan., 1886, p. 26.
[2] Qt. Jour. Geol. Soc., v. XLI, Aug., 1885, p. 354. American Naturalist, Dec., 1885.
[3] Vol. II, p. 564, 1861.

tion by Kroustschoff.[1] The body of the rock is found to consist of orthoclase, completely filled with acicular colorless mica; plagioclase with its twinning lamellæ crumpled and broken; quartz, with liquid inclusions containing double bubbles, and occasionally flattened disks or rounded prisms of a light green, highly refractive mineral; calcite in small rhombohedrons; yellow-brown biotite intimately associated throughout with muscovite and calcite; and bipyramidal prismatic crystals of a colorless mineral, with an extinction of 9–10° against the long axis. The varioles are composed of a central kernel of about the same composition as the rock. Surrounding this is a zone sometimes of calcite, sometimes of quartz, in which the mica occurs. Towards its inner side the mica is arranged in concentric layers, with considerable calcite or quartz between. The central portion contains only calcite and mica. Toward the outer side the calcite diminishes in quantity and the granitic materials take its place. The exterior portion of the variole is composed almost entirely of feldspar and quartz, in which the biotite is concentrically arranged, while the calcite occurs only in isolated grains and rhombohedra. The calcite is regarded as an original constituent, since it is found included in the other minerals, and the varioles are supposed to be concretions.—— Porphyritic hyperite, a rock of granitic structure, composed of plagioclase, hypersthene and diallage, with hornblende, apatite, titanic iron and a little biotite as accessory constituents, is found at San Diego, Cal. Kroustschoff describes[2] the plagioclase as occurring both in the ground-mass and also in porphyritic crystals. The latter are developed most prominently in the plane of the brachypinacoid. Analysis shows them to have the composition Ab_5 An_1.——Herman and Rutley[3] have been studying the devitrification products of glass, heated to a high temperature and allowed to cool suddenly. They find that "in solids free from flaws the devitrification appears to consist in the development of divergent groups of crystals, the divergence being usually limited by a net-work of minute joints, which give rise to small polygonal prisms. The crystalline groups in their respective prisms are banded by arcs of circles." The prismatic structure is approximately normal to the cooling surfaces and the divergent sheaves of the devitrification crystals advance from this surface inward by successive growths within the prism. If the substance however be not homogeneous, crystallization will take place around independent centres irregularly distributed, without reference to the cooling surfaces. In the absence of jointing the whole mass may become spherulitic. These spherulites in a few instances occur within sharply defined circular or approximately circular boundaries, and are

[1] Bulletin de la Société Minéralogique de France, VIII, p. 132.
[2] Bulletin de la Société Minéralogique.
[3] Proceedings of the Royal Society. v. XXXIX. No. 239, p. 87.

made up of little globulites, giving rise to a structure very like that of many of the obsidians from California and other parts of the West.——The natural glasses in the neighborhood of the nepheline basalt of Rossberg, near Darmstadt, are thought by Kroustschoff[1] to owe their origin to the solution in the basalt of foreign quartziferous rocks.

Mineralogical News.—The asterism of Canadian phlogopite was noticed by G. Rose,[2] as early as 1862. He attributed it to the intergrowth of foreign crystals, but did not suggest what might be their nature. Lacroix[3] treated some of the Templeton mineral with hydrochloric acid and examined the residue. It was found to consist of little hemimorphic crystals of rutile elongated in the direction of the vertical axis.——In his examination of basaltic glass from Rossberg, Kroustschoff[4] discovered a pyroxene of a slightly different type from any heretofore described. The new type is transparent and of a very light green color. The crystals are prismatically developed, and show the forms $\infty P \bar{\infty}$, $\infty P \grave{\infty}$, ∞P and $O P$. Very frequently several individuals are united by their clino-pinacoids, sometimes by their prismatic faces. An analysis of the isolated crystals gave:

SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na^2O	K^2O
49.18	2.15	4.96	9.04	20.30	13.07	1.89	0.30

——Harringtonite from Ireland has been examined microscopically.[5] In polarized light it is resolved into an isotropic mass, in which crystals belonging to two distinct species of minerals can be detected. One occurs in little fibrous needles, with longitudinal extinction and negative refraction; the other is in little fragments with broken outlines. The former have the optical properties of mesotype, but are negative. The latter are probably mesotype. Since zeolites are known to have been produced by the action of warm waters, Lacroix thinks that Harringtonite might be looked upon as a gelatinous mass, which has caught up little fragments of the minerals that were floating about in the water in which it was formed. At any rate it can no longer be considered a distinct mineral.

New Books.—The second edition of Rosenbusch's "Mikroskopische Physiographie der petrographisch wichtigen Mineralien,"[6] has recently appeared. This standard work is so very well known that the mere mention of the fact of its revision is sufficient for the purposes of these notes. The advances in the methods of microscopical petrography, the improvements in ap-

[1] Bulletin de la Société Minéralogique de France. VIII, p. 62.
[2] Monatsb. der Berliner Akad. der Wissens., 1862, p. 614; and 1869, p. 344.
[3] Bulletin de la Société Minéralogique de France, VIII, p. 99.
[4] Ib., VIII, p. 85.
[5] Lacroix, ib., VIII, p. 96.
[6] E. Schweizerbart'sche Verlagshandlung (E. Koch), Stuttgart, 1885.

paratus and the very large increase in the amount of literature on the subject within the last twelve years made a second edition of this indispensable book almost imperative. The new edition contains, in addition to a large amount of new matter in the general and special parts, a Newton's scale of prismatic colors (to which reference is made in describing the polarization colors of the different minerals), a practically complete table of petrographical literature and twenty-six photographic plates of mineral and rock sections.——Kalkowsky's "Elemente der Lithologie"[1] is a little treatise of three hundred and sixteen pages, in which the study of rocks is treated as a branch of general geology and not as an appendix to mineralogy. It is intended primarily as an introduction to inorganic geology. In the general part considerable attention is given to the structure, origin and metamorphism of rock masses. In the special part a classification of rocks is attempted, based on the origin of the material of which they are composed. Those whose material was obtained from below are classed as anogenous, those which obtained it from above are called katogenous. Among the latter class belong the sedimentary rocks and the crystalline schists, among which the author places the gabbros and peridotites. Despite the somewhat peculiar views expressed on certain subjects, the book will prove a valuable addition to the library of the lithologist, and a great aid to the student who wishes to study rocks from a geological standpoint.

BOTANY.[2]

THE ADVENTITIOUS INFLORESCENCE OF CUSCUTA GLOMERATA KNOWN TO THE GERMANS.—At the Philadelphia meeting of the American Association for the Advancement of Science, the writer presented a short paper, calling attention to the adventitious inflorescence of *Cuscuta glomerata*. The fact was supposed to be new to science, as it certainly was to the writer, and, moreover, appeared to be to the botanists of the meeting. Additional facts were presented to the Ann Arbor meeting of the Association, and in the discussion the originality of the discovery was not questioned and apparently not doubted by any one.

Imagine my chagrin a few days ago (Dec. 30, 1885), when in running over the text of Dodel-Port's Anatomisch-physiologischen Atlas der Botanik, I found the whole matter fully and accurately described. This atlas was published from 1878 to 1883, in Esslingen. The study of *Cuscuta glomerata* was made in the Botanic Gardens of Zurich, where for ten years or more it has become acclimatized.

On page 4 of part xxx, of the text to the atlas, Dr. Dodel-Port, after describing the normal branching, remarks in substance as

[1] Carl Winter, Heidelberg, 1886.
[2] Edited by Professor CHARLES E. BESSEY, Lincoln, Nebraska.

follows, viz: "Besides this normal branching there is a copious formation of adventitious shoots. These are formed endogenously upon the best nourished parts of the Cuscuta stem, and also upon the parts which bear the haustoria, where the host-plant and parasite are in immediate contact. The rudimentary shoot-buds are formed beneath the cortex of the Cuscuta stem, and break through in a manner similar to the lateral roots of vascular plants. They develop either into inflorescences, or upon injury to the rest of the plant, into vegetation shoots."

These adventitious branches were also noticed, very briefly and somewhat vaguely, by Solms-Laubach in a paper on Parasitic Phanerogams in Pringsheim's Jahrbuch für wissenchaftliche Botanik, vol. VI, 1868.—*Charles E. Bessey.*

SYMBIOSIS BETWEEN A FUNGUS AND THE ROOTS OF FLOWERING PLANTS.—In investigating the structure of the vegetative organs of *Monotropa hypopitys*, M. F. Kamienski (Mem. de la Soc. Nationale des Sciences Naturelles de Cherbourg) came to the conclusion that it is not a parasite, the most careful observation failing to detect any haustoria or other parasitic union with the root of any host. On the other hand he found the root of the Monotropa to be completely covered by the mycelium of fungus which branches abundantly and forms a pseudo-parenchymatous envelope, often two or three times the thickness of the epidermis, and especially well-developed at the apex of the root. This fungus, the species of which M. Kamienski was unable to determine, is entirely superficial, not penetrating into the living cells, though occasionally forcing its way between those of the epidermis. He contends that the Monotropa derives its nutriment from the soil entirely through the medium of this fungus-mycelium. The only parts of the root which are in actual contact with the soil are composed of lifeless cells with no power of deriving nutriment from it. The connection of the fungus with the roots of the Monotropa is not one of parasitism, but of true symbiosis, each of the two organisms deriving support and nutriment from the other.

More recently Dr. B. Frank and M. Woronin (Bericht Deutsch. Bot. Gesellschaft) have made similar observations of the mode of nutrition of Cupuliferæ and Coniferæ. Dr. Frank finds the roots of our native oaks, beeches, hornbeams, chestnuts and hazels to be covered by a dense cortex, to which he gives the name Mycorhiza, organically associated with them in growth, and composed entirely of fungus-hyphæ, completely enveloping the whole of the root, even the growing point. The structure of this cortex is that of a sclerotium; it is composed of a dense mass of hyphæ, varying in diameter from 2 to $10^{mm.}$ usually in several layers, from which other endophytic hyphæ penetrate into the root between the epidermal cells, which are still slenderer than those of the envelope.

By this structure the formation of root-hairs by the tree is entirely prevented, and it is through it alone that it is able to absorb nutriment out of the soil. It makes its appearance first on the lateral roots of the young seedling, and is constantly being replaced by fresh formations on older roots. Dr. Frank found this structure invariably on every root examined of trees belonging to the Cupuliferæ, also occasionally on Salicaceæ and Coniferæ, but never on woody plants belonging to other natural orders, nor on any herbaceous plant. It is quite independent of the nature of the soil. He also regards the phenomenon as an example of symbiosis, comparable in all essential points to that of lichens, the Mycorhiza corresponding to the fungal element in the lichen, the tree itself to the algal gonidia.

Dr. Woronin confirms these statements in relation to Coniferæ, Salicaceæ, and some other trees, and thinks it probable that the fungus, which he regards rather as truly parasitic, is a Boletus.—*A. W. Bennett.*

Internal Spore-Formation in Diatoms.—Count Abbé F. Castracane describes (Accad. Pontif. de' Nuovi Lincei) a remarkable appearance in a deposit of marine diatoms of Pliocene date from the Apennines. In a specimen of *Coscinodiscus punctulatus* he observed that the lower part of the valve, minutely punctuated in radial disposition, showed small uniform round stalked bodies; drawings under the camera lucida showed clearly their circular figure. No other interpretation of these minute round bodies, always found in the interior of the frustule, seems possible, except that they constitute a nest of embryonal diatoms on the point of escaping from the mother-cell. This is in accord with previous observations of the author on similar round bodies seen on the point of escaping from a Podosphenia, and with observations of Rabenhorst and O'Meara. The fact that the diatoms in which these bodies were observed had previously been treated with boiling sulphuric acid with addition of potassium chloride, shows conclusively that the round bodies seen to escape from living diatoms are not Infusoria or other organisms fortuitously collected round them, and demonstrates at the same time that, from the first moment of their existence, diatoms must be provided with a siliceous coating, though it may be of extreme tenuity. It would seem from these observations that diatom may assume the function of a sporangium, producing in its interior embryonal forms by which the species is reproduced, and which ultimately acquire the form and approximately the size of the mother-frustule.

In connection with this subject, Mr. F. Kitton states (Jour. Quekett Micros. Club) that he found on carafes of water a film composed entirely of frustules of *Achnanthes linearis;* but on filtering the water, these were never found on the filter-paper, and when the filter-paper was boiled in decarbonized sulphuric acid, the residue showed no indication of carbonaceous remains. In the course of a few days a film again began to appear on the filtered water, which was found to consist entirely of the same diatoms. A control experiment showed that none of these diatoms, though exceedingly minute, would pass through the filter-paper employed, and the conclusion seems inevitable that the diatoms must have passed through in the form of microspores.—*A. W Bennett.*

BOTANICAL LABORATORIES IN THE UNITED STATES.—In a most instructive paper in the December number of the *Botanical Gazette*, Mr. Arthur gives descriptions of some of the more important botanical laboratories in this country. Those noticed are the following:

1. *Harvard University.* (*a*) The laboratory in connection with the Botanic Gardens. (*b*) The laboratory of Cryptogamic Botany in the Agassiz museum. (*c*) The laboratory of phanerogamic botany in Harvard Hall. Twenty-one compound microscopes are supplied to these.
2. *Cornell University.* (*a*) The laboratory for analytical and general phanerogamic work with eleven dissecting microscopes. (*b*) The microscopical laboratory and conservatory, supplied with twelve compound microscopes.
3. *University of Pennsylvania.* (*a*) Laboratory for junior work, containing an outfit of dissecting microscopes. (*b*) Laboratory for senior work. These contain twenty-four compound microscopes.
4. *Illinois University.* Laboratory and green-houses, supplied with twenty-one compound microscopes.
5. *Michigan Agricultural College.* Laboratory and conservatory, supplied with twenty-seven compound microscopes.
6. *University of Michigan.* (*a*) Microscopical laboratory, with forty-three microscopes; (*b*) The botanical laboratory proper, with six microscopes.
7. *Iowa Agricultural College.* Laboratory supplied with twenty-one compound microscopes.
8. *Wabash College.* (*a*) Laboratory for elementary botany, with an outfit of dissecting microscopes. (*b*) Laboratory for advanced botany, supplied with twenty compound microscopes.
9. *Perdue University.* Laboratory supplied with twenty-five compound microscopes and an equal number of dissecting microscopes.
10. *University of Wisconsin.* (*a*) Laboratory for elementary work, supplied with eleven dissecting microscopes. (*b*) Laboratory for advanced work, supplied with twenty-five compound microscopes.
11. *University of Nebraska.* Laboratory supplied with twenty-five dissecting microscopes, and thirty-six Coddington hand-lenses, for elementary work; and twenty-two compound microscopes for advanced work.
12. *The Shaw School of Botany.* Laboratory supplied with sixteen dissecting microscopes for elementary work, and four compound microscopes for advanced work.

LINHART'S UNGARNS PILZE, CENTURY IV.—This important distribution of Fungi deserves mention again, both on account of the beauty of the specimens and the low price at which they are furnished. The century before us contains thirty-six species of Uredineæ, three of the Ustilagineæ, six of Peronosporeæ, three of Erysipheæ, etc., etc. Good plates are given of fifteen species, and in these the microscopical details of structure are quite satisfactorily worked out. When these plates are mounted upon the same herbarium sheets as the specimens which they illustrate, they will prove very useful and instructive, especially to the beginner in Fungology.

BOTANICAL NEWS.—The "Laboratory number" (Dec.) of the *Botanical Gazette* is one of the most valuable issued during the past year. The special laboratory topics are, Some botanical laboratories of the United States; Laboratory appliances; The laboratory at Strasburg; Laboratory courses of instruction; Section cutting, besides a dozen or so general notes devoted to some phase of the subject.——A late number of *Flora* contains a paper on the infloresence of Typha, by Celakoosky.——No. 141 of the Journal of the Linnean Society contains: (1) Contributions to the Flora of the Peruvian Andes, with remarks on the history and origin of the Andean Flora, by John Ball; (2) Contributions to South-African botany, by H. Bolus and N. E. Brown; (3) A contribution to the study of the relative effects of different parts of the solar spectrum on the transpiration of plants, by George Henslow.——The December *Torrey Bulletin* contains the summary of another year's work upon the fresh-water Algæ of the United States, by Francis Wolle. Several new species are described, viz: *Ectocarpus rivularis* (Florida), *Œdogonium cataractum* (Florida), *Dictyosphærium hitchcockii* (N. J.), *Zygnema purpurea* (N. J. and Fla.), *Mesocarpus crassus* (Fla.), *Staurastrum tokopekaligense* (Fla.), besides a number of varieties. A plate of Desmids accompanies the paper. ——The *Gardeners' Monthly*, while not professing to be a botanical journal, contains much of value and interest to the botanist. Thus in the January number we find papers on the following subjects, viz: A new pitcher-plant (*Sarracenia courtii*), The so-called hardy Catalpa, Large sassafras trees, *Amaryllis treatæ*, The mistletoe in different localities, besides many notes and notelets.——Gerald McCarthy, of Kendall Green, Washington, D.C., announces a distribution of plants of Eastern North Carolina, including 340 species at $21.——For those intending to buy botanical works we are doing a good service when we call attention to John Wheldon's botanical catalogues (58 Great Queen street, London, W. C., Eng.).——The Index to the twenty-third volume of the *Journal of Botany*, just closed, enumerates an unusually great amount of valuable matter. Among the contributors are the well known names of J. G. Baker, A. W. Bennett, M. C. Cooke, J. M. Crombie, W. B. and H. Groves, W. B. Hensley, M. T. Masters, F. von Mueller, Henry Trimen, etc.——One of the pleasant features of the past few months has been the attention given in so many journals to notices of Dr. Gray. The latest of these which we have is a neat paper reprinted from the *Sun* newspaper of Jan. 3, and entitled "Asa Gray." It is from the hand of Professor C. S. Sargent, and gives a summary of the life and labors of the eminent botanist. Very like the foregoing is the paper in the January *Botanical Gazette*, by Professor C. R. Barnes. In this paper, however, we have more of the personal history. It is accompanied by a fine heliotype.

ENTOMOLOGY.

WITLACZIL ON PSYLLIDÆ.[1]—In 1883 Dr. Witlaczil published his researches on the anatomy of the Aphides, and in 1884 on their embryology (of which paper we gave an abstract in AMERICAN NATURALIST, Feb., 1885). He now furnishes an additional contribution to the anatomy of the Phytophthira, or plant-lice, making the small group of Psyllidæ the subject of important researches; his exposition of the structure of the insect brain being of exceptional value. The species examined by him represented the genera Psyllopsis, Rhinocola, Psylla, Homotoma, Trioza. His methods were teasing in saline solutions, treating with dilute acetic acid the fresh and stained animals entire and making sections in the Naples way with Jung's microtome.

In external appearance the Psyllidæ are small (about a millimeter in length) differing from other families of Homoptera by the similarity of both sexes, which are winged and are provided with a pair of compound eyes and three simple ocelli, and have ten jointed antennæ, the two joints next the base short and thick, and the terminal joint bearing a pair of bristles. During life the antennæ are constantly vibrating. Figs. 1, 2 show the male,

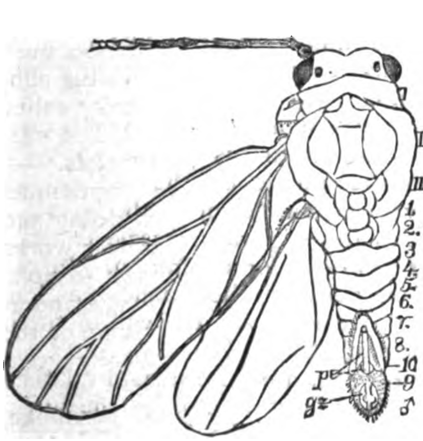


Fig. 1.

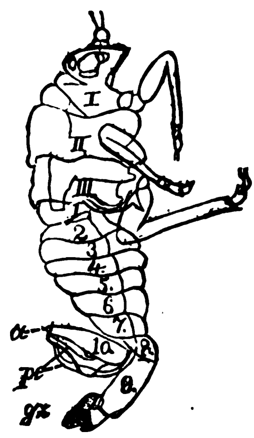


Fig. 2.

FIG. 1.[2]—Psyllopsis, ♂, dorsal view, right wings removed. FIG. 2.—The same, lateral view, wings removed.

[1] Die Anatomie der Psylliden, von Dr. Emanuel Witlaczil in Wien. Zeitschrift für Wissenschaftliche Zoologie, Vol. XLII (1885), pp. 560–658, and pl. XX–XXII.

[2] *Explanation of reference-letters in the figures.*—*a*, anus; *al*, antennal lobe; *an*, abdominal nerve; *at*, antenna; *ats*, antennal swelling; *cb*, central body of brain; *cp*, crop; *es*, eye swelling; *ga*, ganglion, *gz*, genital hooks; *h.in*, hind-intestine; *id*, inner decussation; *ln*, limb nerve; *mb*, mushroom body; *Mg.v.* malpighian vessels; *m.in*, mid-intestine; *ml*, mid-lobe of brain; *oc*, compound eye; *ocl*, ocellus; *od*, outer decussation; *oes*, œsophagus; *om*, outer medullary layer; *pe*, penis; *rc*, rectum; *s.oe*, sub-œsophageal ganglion; *st*, stomach; *vn*, ventral nerve-cord. Roman numerals indicate thoracic somites and Arabic numerals abdominal somites.

whose abdomen is slightly compressed. The abdomen of the female is rounded. The wings of these insects and of the winged forms of Aphides are used chiefly as parachutes. The coxæ of the limbs coalesce with the thorax, and the tarsi are two-jointed, bearing a pair of terminal claws. The hind-limbs are specialized for springing. The first abdominal somite of both sexes is added to the metathorax to enlarge the springing-gear; the second abdominal somite forms a short stalk for the abdomen, and the terminal abdominal somites are so modified as to have misled the systematists. In the male the tenth somite seems to be inserted on the eighth, as the ninth has only its ventral part developed and ends the abdomen, whilst the tenth, bearing the anus and penis, is reverted dorsad. In the female the ninth somite is discernible only by its appendages, and the tenth is a roofing dorsal plate (the upper genital dorsal plate of Löw) bearing in its center the anus fringed by wax-glands. Thus in both sexes the typical number of ten somites can be found.

The circum-anal wax-glands are in the larvæ of both sexes; and wax-glands producing wax-fibrils are present on other parts. Wax-particles sometimes cover the larvæ, protecting the back from excrementitious matter. Some larvæ (Psyllopsis) have spear-shaped wax-hairs; the larva of Trioza has a marginal row of leaf-like wax-plates. All the wax-hairs arise like chitinous hairs from large hypodermal cells, which have vacuoles presumably filled with the secretion-fluid.

The stigmas of the tracheal system are denticulated on each side, and have a self-acting closing apparatus (not as described by Landois). They have a short muscle on the ventral side, so connected with the dorso-ventral muscles of the body that on the contraction of these muscles the stigmatic muscle contracts and opens the valve. This is probably for expiration. Inspiration is effected by the mere elasticity of the tracheæ, and the stigmatic valve closes by its own elasticity. The will of the insect does not control these movements.

The *nervous-system* and *sense-organs* are here treated relatively to insects in general, and much new light is cast on the subject of the insect's psychology. The brain of the Psyllidæ is rather large, having a middle lobe and two lateral lobes, the latter sending off the optic nerves (Figs. 3, 4).

The median lobe is prolonged downwards into the procephalon.[1] Its posterior part becomes the two commissures leading to the subœsophageal ganglion, from which the mouth-organs are innervated. The ventral nerve-cord has four ganglia, three for the limbs and a fourth for the abdomen whose ganglia are fused into a single mass. The brain-mass is much as in other insects, having a central medullary system and a peripheral layer of a cortex

[1] Thus I render Vorderkopf; "procephalic-lobes" is inaccurate, as the part is not paired; the term "forehead" is preoccupied.—*G. M.*

of ganglion-cells which fails only at its posterior part. The ganglion-cells are polygonal or roundish, varying in size; they have a horny nucleus, and become stained whilst the medullary part remains clear.

The *compound eyes* are well described by Viallanes (Ann. des Sci. Naturelles, 1882) for Musca. In Psyllidæ they are somewhat simpler, having (1) at the surface numerous separate lenses of the cornea, slightly biconvex, (2) below them a layer of crystalline cones, often brownish, (3) next comes a dark layer of rhabdites forming the retina; each rhabdite being a slender truncated cone, narrowing inwards. The whole system of rhabdites converges towards the center of the eye, whence nerves run towards the brain. The subsequent layers of Viallanes (post-retinal fibers, ganglion cell-layer, palisade-layer and chaplet-cells) cannot be clearly recognized in Psyllidæ. The retinal fibers pass by the

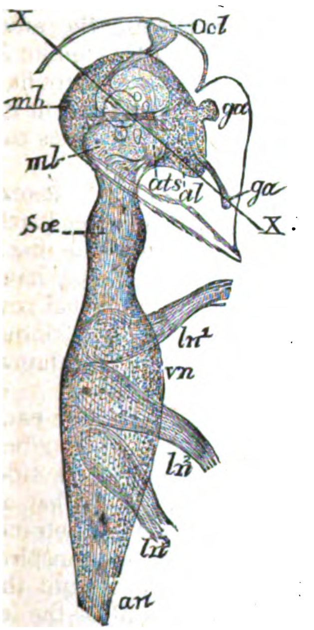


Fig. 3.

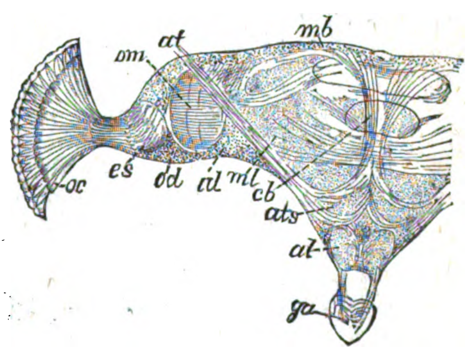


Fig. 4.

FIG. 3.—Nervous system of Psylla. FIG. 4.—Transverse section of brain of Psylla, along line X X of Fig. 3.

ganglion cell-layer into the "eye-swelling" (*es* of Fig. 4) (the optic ganglion of Viallanes), an enlargement of the medullary substance. The fibers passing this way toward the median brain-mass form an "outer decussation" (*od*). Some fibers from this decussation go to the adjoining cortex, some to the outer part of the medullary layer, some pierce this so as to reach the inner decussation (*id*), and some proceed thence across the brain so as to form a chiasma with fibers from the opposite eye. Some fibers from the eyes and some from the other outer lobes of the brain find their way to the *central body* (Fig. 4, *cb*) in the mid-lobe, and nerves may be traced from all these lobes and from the central body to the anterior cortex of the brain with its abundant ganglion-cells.[1]

The *simple eyes* have biconvex lenses and rhabdites joined to nerve fibers, which run back to the infero-posterior region of the brain, and thence advance so as to enter the central body. The antennal nerves run straight back to the antennal lobes (*al*), whence some fibers run forwards to the central region of the brain.

The "central body" has been described by investigators as a fan-shaped organ. Packard,[2] after Newton, described it as a half-moon-shaped body, concave backwards and separated by a network of fibers from the brain, and supposed it to consist of modified cells. In Psyllidæ it is bean-shaped, consisting of granulated matter not at all isolated from the surrounding parts of the brain, but receiving fibers from and sending fibers to the other lobes, and is nothing more than a central commissural system, its cell-like elements being the cross-sections of fibrous masses.

The *mushroom-bodies*, described by authors, are found in Psyllidæ only in a rudimentary form, being some thick masses of ganglion-cells in the upper anterior border near the median line, whence bundles of fibers run backwards.

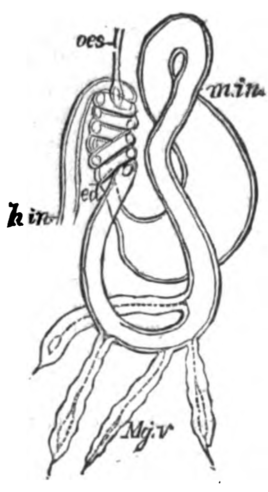


FIG. 6.—Digestive tract of Psyllopsis.

Taken as a whole the brain, with its connections with procephalic ganglion-masses, subœsophageal commissures and ventral nerve-cord, and various lobes in its own mass, is complex; and it is scarcely possible to join sections made in different directions into a unity, so as to get its real structure. As a whole its inner part is a central nerve system consisting of fibrous masses, which on the one side end in a sense-organ or in a peripheric nerve, and on the other in a cortical layer of the brain, entering its ganglion-cells. The insect-brain is, therefore, a projection-centrum, the mushroom-body being special. The most important nerves entering the brain (as from the eyes, antennæ, limbs) cause a swelling in its medulla, where the fibers are deflected so as to change their course.

Digestive tract.—The mandibles and first maxillæ are developed

[1] S. J. Hickson (in Quarterly Journal of Microscopical Science, April, 1885) uses the terms *opticon*, *epiopticon* and *periopticon* for three medullary masses belonging to the eye of Musca; representing respectively *om*, *es*, and a tract near *oc* of our Fig. 4.—*G. M.*

[2] Second report U. S. Entomol. Commission, 1878–9. The literature of the subject is there given.

into "retort-shaped organs," and the second maxillæ form a short under lip which is inserted on the short prothorax. The piercing stylets are very long, lying in a groove of the under lip, and at their base forming loops which are enclosed in a dermal sac. This is the structure also in Coccidæ, as Dujardin and Mark shew [and is well seen in the larval seventeen-year Cicada.—*G.M.*]. The œsophagus is narrow, extending as far as the abdomen, where the stomach and beginning of the mid-intestine coalesce with the hind-intestine (Fig. 5), the two parts winding round each other in several turns. This coalescence is caused by the contraction of the mid-intestine. Mark shews that in Coccidæ the arrangement is different, the end of the œsophagus and beginning of the stomach having a small winding loop which is received into a sac formed by the hind-intestine. This latter is also the way in Cicadidæ. The malpighian vessels are four, short and distinct, their ends running into a suspensory ligament. They are wanting in Aphides and Chermetidæ.—*G. Macloskie.*

Entomological News.—A paper by Dr. E. Witlaczil, on the morphology and anatomy of the bark lice (Coccidæ) appears in Zeitschrift für Wissens., Zoologie, issued Dec. 31, 1885.——Dr. R. von Limbeck has investigated (Litzungsber, K. Akad. Wissenschaften, Wien, 91, 1885, p. 322) the histology of the yellowish-brown and white muscles of insects; the former are thoracic and belong to the wings, the latter are abdominal muscles, and largely form those moving the hind limbs.——According to *Science* for Jan. 15, the city of Mexico has for a number of months past been afflicted with a scourge of mosquitoes, which have abounded so as to cause sickness, and, it is said death, by their poisonous bites.——The grand prize in anatomy and zoölogy of the French Academy has been given to Dr. J. Chatin for a work, as yet unpublished, on the tactile organs of insects and Crustacea.——The Transactions of the Entomological Society of London, Dec. 2, 1885, contain an interesting life-history of a trap-door spider (*Atypus piceus*), by F. Enock; also an essay on the classification of the Australian Pyralidina, by E. Meyrick. He divides the group into thirteen families, and estimates the number of described species throughout the world at 2500. He thinks that the Phycidæ may be regarded as a development of the Galleriadæ, the Botydidæ of the Scopariadæ, and the Hydrocampidæ and Musotimidæ of the Pyralididæ. * * * The Tineodidæ (formed for the reception of the genus Tineodes), Oxychirotidæ, Pterophoridæ, and Alucitidæ on relics of a once more extensive section of the group, now reduced to a fragmentary condition, and approaching most nearly to the Crambidæ and Scopariadæ."

ZOÖLOGY.

THE PROATLAS, ATLAS AND AXIS OF THE CROCODILIA.—I. *Proatlas.*—In all Crocodilia there is developed an osseous piece between the skull and the neurapophysis of the atlas. This piece is called "kleines niedriges Bogenstück" (Meckel[1]); "lame transverse" (Cuvier[2]); "oberes Schluss-Stück" (Stannius[3]); "oberer Bogen" (Bruch[4]); "Spinal — oder Dachstück" (Brühl[5]); "neural spine of the atlas" (Owen[6]); "proatlas" (Albrecht[7]); "postoccipital bones" (Marsh[8]).

Bruch (l. c., 1861) was the first to give the correct explanation of this piece, he ***considers it as the neurapophysis of a vertebra, between the skull and the atlas.***

In 1880 Albrecht[9] reached the same result (l. c.).

Brühl and Marsh consider the elements in question as belonging to the skull; Dollo[10] has shown in extenso that this view is wrong, and that the "postoccipital bones" really represent the "proatlas" of Albrecht, and therefore parts of the vertebral column.

Eudes-Deslongchamps[11] says that it "représente l'arc postérieur de l'atlas chez l'homme."

Dollo (l. c.) has given a list of vertebrates in which the "proatlas" has been observed; it is not necessary to repeat it.

I have to add only some few points:

1. The proatlas is developed from two different cartilages exactly in the same way as all neurapophyses.

2. The two parts may be distinct in the young animals, and even in adult ones.[12] In a nearly ripe embryo of *Jacare vallifrons* I find two elongated osseous elements. In a young *Alligator*

[1] Meckel, J. F. System der vergleichenden Anatomie, 2 ter Theil. Abth. 1, Halle, 1824, p. 430.

[2] Cuvier, G. Recherches sur les ossemens fossiles, Quatr. éd., Tome IX, pp. 192–193, Paris, 1836.

[3] Stannius, H. Lehrbuch der vergleichenden Anatomie der Wirbelthiere, Berlin, 1846, p. 134.

[4] Bruch, C. Vergleichende Osteologie des Rheinlachses, Mainz, 1861, p. 134.

[5] Brühl, C. B. Icones ad zootomiam illustrandam, Das Skelet der Krocodilinen, Wien, 1862, pp. 2–3.

[6] Owen, R. On the anatomy of Vertebrates, Vol. I, p. 65, London, 1866.

[7] Albrecht, P. Ueber den Proatlas, einen zwichen dem Occipitale und dem Atlas der amnioten Wirbelthiere gelegenen Wirbel, Zool. Anzeiger, 1880, p. 475.

[8] Marsh, O. C. Principal characters of American Jurassic Dinosaurs, Part VI. Restoration of Brontosaurus, Am. J. Sc., Vol. XXVI, Aug., 1883, pp. 82–83.

[9] It is generally believed that Albrecht first showed the true nature of these bones, but, as I have said, Bruch already had the same idea nearly twenty years before Albrecht.

[10] Dollo, L. Cinquieme note sur les Dinosauriens de Bernissart, Bull. Musée Roy. Hist. Nat. Belg., Tome III, 1884, pp. 129–135.

[11] Eudes-Deslongchamps. Mémoires sur les Téléosauricus de l'époque jurassique du département du Calvados. Mém. Soc. Linn. Normandie, Vol. XII, Caen, 1863, p. 43.

[12] Huxley, T. H. A manual of the anatomy of vertebrated animals. London, 1871, p. 251.

mississippiensis the bones are separate but not elongated as in Jacare. Usually the two elements unite early in the embryo.

3. It is possible that a proatlas existed in Rhynchosaurus Owen, a reptile very nearly allied to Sphenodon (Hatteria). Sphenodon has rudiments of the proatlas, as shown by Albrecht;[1] therefore the same bones ought to be present in Rhynchosaurus; this seems to be confirmed by a note by Owen[2] on this reptile.

"A small flattened triangular plate, which adhered to the posterior part of the skull, was suspected by Dr. Ward to be a tooth; it appeared to me, from the character of the exposed surface, to have at least equal claims to be regarded a dermal scute. In preparing the mold of the cranium this part was detached and lost, a circumstance which I have much regretted, since it prevented my applying to it the test of a microscopical examination."

In his detailed description of Rhynchosaurus, Owen[3] does not mention this point.

I believe it possible that the small flattened triangular plate, "which adhered to the posterior part of the skull," represents a piece of the proatlas.

It is probable that the proatlas is present also in the Protorosauria, which have many characters common with Sphenodon.

II. *Atlas and Axis.*—The centrum of the atlas is always represented by the odontoid process of the axis, and can be separated easily in the Crocodilia. The piece below the centrum of the atlas, supporting the neural arch of that vertebra, is the *hypapophysis*, between the proatlas and the atlas.

The hypapophysis between the atlas and axis is probably coossified with the anterior and lower part of the axis-centrum, as in birds and some dinosaurs. There seems to be a great confusion in the determination of the ribs belonging to the first vertebræ in the Crocodilia, and even about the true nature of these vertebræ. Koken[4] says, 1882: "Es ist erstaunlich und befremdend, wie sehr bei diesen sonst so conservativen Thieren die Ausbildung der ersten Halswirbel, und zwar in wesentlichen Punkten, differirt. Vorläufig erscheint es unmöglich, in Art und Reihenfolge der Veräenderungen eine Gesetzmässigkeit zu bringen."

This is very strange indeed. We find it very much more "befremdend," that Koken says (p. 808), that an alligator (*A.*

[1] Albrecht, P. Note sur la présence d'un rudiment de proatlas sur un exemplaire de *Hatteria punctata* Gray. Bull. Mus. Roy. Hist. Nat. Belg., T. II, 1883, p. 190.

[2] Owen, R. Report Brit. Fossils, Rept. II; Brit. Assoc. Rep., 1841, p. 150.

[3] Owen, R. Description of an extinct lacertilian reptile (*Rhynchosaurus articeps* Owen) of which the bones and footprints characterize the upper new Red sandstone at Grinsill, near Shrewsbury. Cambr. Philos. Soc. Trans., VII, 1842, pp. 354–369.

[4] Koken, E. Die Reptilien der norddeutschen unteren Kreide. Zeitschrift Deutsch. Geol. Gessellsch. Jahrg, 1883, p. 808.

darwini) and a crocodile (*C. ebertsi*) *have no hypapophysis*, following Ludwig's[1] wrong description.

All reptiles possess the hypapophysis (unteres Schluss-stück) of the atlas, and it is quite injudicious that Ludwig and Koken could deny the existence of such an element in an alligator and a crocodile *from the Tertiary*.

The matter is very simple. Ludwig described the true hypapophysis of *A. darwini* as the centrum of the atlas; the axis centrum + the odontoid process as the centrum of the axis. Ludwig says that the odontoid process of the axis is wanting in *C. ebertsi*, but he describes it. He makes something very remarkable out of its separation from the axis. He did not find the hypophysis, and therefore he says this element is wanting.

There is no doubt whatever that the atlas and axis of Alligator darwini and Crocodilus ebertsi possessed the same structure as the living alligators and crocodiles.

Koken finds similar difficulties in the articulation of the ribs (p. 809). "Die zum Epistropheus gehörige Rippe ist bei den lebenden Crocodilinen gegabelt und gelenkt (nur mit dem Capitulum) zwischen Epistropheus und Dens Epistrophei, mehr am lezteren.

"Bei *Crocodilus ebertsi* ist sie ganz auf den Atlas-Körper übergegangen, bei *Alligator darwini* trägt degegen der Epistropheus die Rippe, bei beiden ist sie einfach.

"Bei Enaliosuchus setzt sich die einfache Rippe an die Diapophyse des Epistropheus, während die Parapophysen keine Rippen stützen.

"Bei Teleosaurus ist sie gegabelt und sowohl an Diapophyse wie Parapophyse inserirt.

"Bei Teleosaurus findet sich ferner ein drittes Rippenpaar, welches intervertebral zwischen Atlas-Körper und Epistropheus articulirt."

If these characters are true, we have to abandon the value of morphology. But we hope to show that the above statements are wrong or incorrect.

1. In the living crocodiles the rib of the axis shows the following conditions:

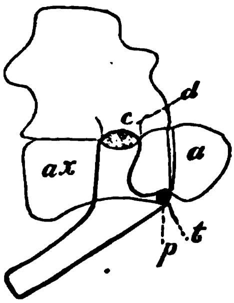
In *Gavialis gangeticus* the capitulum of the axis-rib articulates only with the centrum of the atlas. There is developed a rudimentary diapophysis in the neural arch of both sides. The tuberculum of the axis rib does not reach that diapophysis, but is probably connected with it by ligament.

In an adult *Alligator mississippiensis* the capitulum articulates

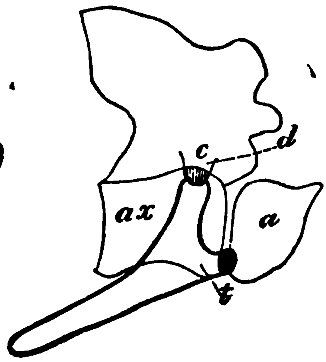
[1] Ludwig, R. Fossile Crocodiliden aus der Tertiaerformation des Mainzer Becken, Palaeontographica. Suppl. III, Lief. 4 u. 5, Cassel, 1877, pp. 13–14, p. 37.

with the atlas-center and by a *very small* face with the axis-center also. There is no trace of a diapophysis. The tuberculum does not reach either the axis or the atlas, but is connected with the *atlas* by ligament.

SCHEMATIC FIGURES, SHOWING THE RELATION OF THE AXIS-RIB TO ATLAS AND AXIS.

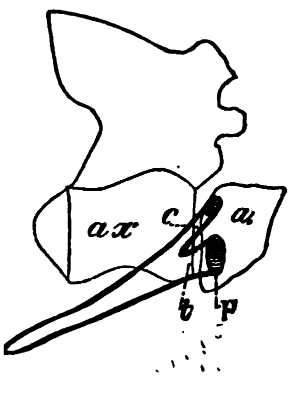


Teleosaur.

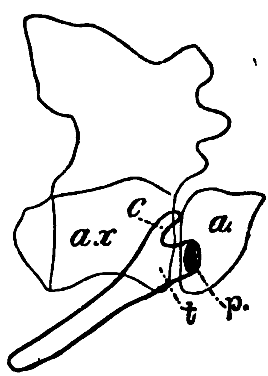


Enaliosuchus.

Gavial.



Alligator, young.



Crocodilus.

a, atlas-centrum; *ax*, axis-centrum; *d*, diapophysis; *p*, parapophysis; *c*, capitulum; *t*, tuberculum.

In a very young *A. mississippiensis* the tuberculum is complete, and articulates with the atlas-center; the *capitulum* articulates with the same bone.

In *Crocodilus americanus* Schneid., the capitulum articulates with the atlas-center, the tuberculum touches the neurapophysis of the axis, but there is no face on that bone.

2. *Crocodilus ebertsi* shows the same conditions as *A. mississippiensis.*

In *Alligator darwini* the axis-rib is connected with the atlas-center. Ludwig, considering the atlas + axis as the axis, says that it articulates with the axis.

3. In the Enaliosuchus-axis a diapophysis is present. Koken believes that Enaliosuchus has a simple rib connected with this diapophysis. This can not be correct; if the diapophysis is present there must be an articulation for the tuberculum of the rib. The tuberculum never disappears before the capitulum. I believe that in Enaliosuchus (if it really belongs to the Crocodilia) a complete rib was developed in the axis, the capitulum articulating with the well-developed diapophysis, the tuberculum with the axis-centrum or with both the axis and atlas, or with the atlas alone. This face will probably be found if the atlas-rib is removed.

4. In the Teleosaurus-axis the diapophysis and the parapophysis are developed and the ribs two-headed.

Deslongchamps describes an additional rib connected with the atlas-center, but he figures no articular surface for this rib on the atlas. It is a morphological impossibility that a rib should exist between the ribs of the atlas, connected with the hypapophysis, and that of the *axis.*

At first when I saw Deslongchamps's figures I reached the conclusion that the axis-rib had entirely disappeared in the living Crocodilia, and that the *rib in question* represents the rib connected with the atlas-center (the true atlas-rib), but since I have shown that the axis-rib has not disappeared in the living Crocodilia, but is shifted in front of the axis successively, I must abandon this view.

Koken believes that the additional "rib" in Teleosaurus represents the tubercular part of the atlas-rib. This may be, but it is *not* probable. If the atlas and axis of the Parasuchia (Belodon, Stagonolepis) are known, we probably will get more light on this point.

I give the following results:

All crocodiles possess a hypapophysis (unteres Schluss-stück) of the atlas.

All crocodiles possess ribs of the atlas and ribs of the axis.

In the older crocodiles (Teleosaurus) the axis-rib has a well developed capitulum and tuberculum, the latter articulating with a well-devloped diapophysis. A similar condition is shown in Enaliosuchus from the Lower Cretaceous.

Later the diapophysis, and with it the capitulum, get rudimentary, the axis-rib loses its articulation with the axis and is shifted to the atlas.

This process is shown by the following diagram (relation of the axis-rib to the atlas and axis):

	Capitulum.	*Tuberculum.*	*Diapophysis.*	*"Parapophys."*
Teleosaurus.	articulating with "parapoph." of axis. (hypapophysis)	articulating with diapophysis	well developed	present on the anterior and lower part of axis (hypapophysis)
Enaliosuchus.	"	"	"	on the axis or atlas, or between them
Gav. gang.	articulating with "parapophysis"	rudimentary, connected by ligament with the rudim. diap.	rudimentary	present on the atlas-center
Allig. mississ. and other croc.	articulating with "parapophysis"	rudimentary, connected by ligament with the atlas or axis, if present connected with atlas	wanting	present on the atlas-center, partially on the axis

—*Dr. G. Baur, Yale College Museum, New Haven, Conn, Jan. 7, 1886.*

Three problematical Genera of Mexican Boæform Snakes.—Besides genera of typical Boidæ known to inhabit Mexico and Central America, three genera have been found whose position has been more or less uncertain. These are Charina Gray, Lichanura Cope, and Loxocemus Cope. All of them have been referred by one or another author to a supposed family Erycidæ, the type of which is the genus Eryx of India and Africa. This family has, however, no further definition than the non-prehensile character of its tail; in all other respects its members agree with the Boidæ. This prehensile character is, however, well known to be extremely evanescent in snakes, and to have no greater than generic value, and sometimes not even that. The tail of Lichanura can hardly be assigned to the one category more than to the other.

Some years ago I referred Loxocemus to the Pythonidæ, a course which has generally been adopted by authors; while the two others have been kept in the Erycidæ, Mr. Garman having gone so far as to unite them. An examination of the skeleton, however, shows that they all differ materially from each other, and must be referred to three separate families, viz., the Pythonidæ, the Boidæ and to the new family of the Charinidæ. The definitions of these families are as follows:

Supraorbital, postfrontal and coronoid bones present.................. *Pythonidæ*.
Postorbital and coronoid bones present; no supraorbital.................. *Boidæ*.
Neither postfrontal, supraorbital nor coronoid bones present............ *Charinidæ*.

—*E. D. Cope*.

NOTE ON THE PROBLEM OF SOARING BIRDS.—In the interesting paper on soaring birds, by I. Lancaster, published in Nos. 11 and 12 of the NATURALIST for 1885, the writer attributes the power which is utilized by the bird, no doubt correctly, to the condensation and expansion of the atmosphere, produced by the relative motion of the bird with respect to the atmosphere.

An evaluation, if it were practicable, of the excess of the upward, above the downward, atmospheric pressure upon the bird, when it soars horizontally or remains stationary on fixed wings, would show, no doubt, that such excess is exactly equal to the weight of the bird; and the rear expansion on a vertical section of a bird that remains stationary on fixed wing in a current of air, would be found to be exactly equal to the force exerted by the breeze. No other explanation of the phenomenon is conceivable, and this is substantially the explanation suggested by Mr. Lancaster. But he errs in his attempt to show that a bird can "soar" as a result of the action of gravity alone, without descending toward the earth, that is, without sacrificing its energy of position (potential energy). He has apparently been led into this error by a misconception of the phenomena of resultant motion, or by confounding force and motion; for he assumes that when a body is descending uniformly through the atmosphere and is therefore meeting with atmospheric resistance equal to its weight, it may, at the same time, by the action of an upward lateral force resulting from the condensation produced by its descent, have an upward lateral motion, so that its vertical ascent shall equal its vertical descent.

This is obviously a misinterpretation of the phenomena; for it is well known that the upward lateral force would arrest the downward motion, so that the *cause* of the upward motion would be immediately withdrawn; and besides, it leads to the absurd conclusion that the secondary effect of gravitation, through the condensation and expansion of air, may exceed that of its direct action.

Obviously the best the bird can do to sustain his elevation in still air, will be, by suitable position of his wings, to effect a *succession* of descents and ascents, thus utilizing, not only the condensation produced by his descent, but also the momentum acquired by his velocity.

It follows, therefore, that soaring birds utilize *two* forces, viz.; gravity and the *motion* of the atmosphere, and that without atmospheric motion other than that produced by his descent, a soaring bird cannot for an instant maintain, undiminished, his energy of position.—*J. E. Hendricks, Des Moines, Iowa, Jan. 14, 1886.*

On the Types of Tooth-structure in Mammalia.—The trifid form of the lower molar of the genus Monachus and of Mesonyx is in reality repeated in the cusps of the molars of Ungulata generally. In Sus the second upper molar cusp[1] sends a long basal process forward and outward toward the canine cusp and may be said to represent the anterior cuspule of the trifid figure of the plan of cusp itself, while the posterior cuspule is aborted. The bicuspid cusp exhibits a small anterior cuspule which extends directly outward to reach the base of the canine cusp. Both the ridges formed by these cuspules are the first to become worn in mastication. This plan of arrangement is repeated in several extinct genera. among which may be mentioned Phenacodus and Hyracotherium.

In *Hyracotherium cuspidatum*[2] the cuspule is placed obliquely to the true molar cusp, precisely as in Gymnura, instead of being continuous with the cusp. The differences between the cusp and the oblique prolongation of the first molar cusp forward and inward being one of degree only.

In *Pliolophus vintanus*[3] the arrangement of the cusps appears to be exactly that of Sus. The only features which are lacking are those of the heel of the tooth and the shapes of the cusps themselves.

It may be said that the presence of ridges, especially of the oblique ridges, entering into the triturating surfaces of the tooth, relate to the survival of the small basal cuspules of the trifid figure. As may be easily supposed the direction of the ridges is subject to much variation. In man such direction is along a line which connects the first molar and the bicuspid cusps, and this arrangement appears again in Hippopotamus. In *Mastodon americanus* and Achænodon the cusps are without cuspules, which are seen only in aberrant examples of the last molars. In the former genus they have been figured by Leidy.[4]

The ridges representing the cuspules are unnamed in any regular manner by authors. They are said by Owen[5] to exist in the human tooth only. Leidy calls them the "accessory eminences," Cope[6] the "lesser tubercles," "crests," etc. They enter into the

[1] The nomenclature of the cusps proposed by me in 1874 (*Dental Cosmos*, XVI, p. 617) is here followed.

[2] Cope. Wheeler's Survey, IV, p. 267, pl. LXV, fig. 18.

[3] Ibid, pl. LXV, fig. 1.

[4] Extinct Mammalia of Dakota and Nebraska, p. 245, pl. XXVII, f. 13, 15.

[5] Odontography, p. 453.

[6] Journ. of Acad. of Nat. Sci., 1874.

"interstitial" type of tooth of Ryder.[1] They constitute in part the intermediate (median denticules) cusps of Gaudry.[2] The object of the cuspule is to support the cusp, to the base of which it is attached. Indeed, it presents the first attempt to modify the bunodont type of dentition toward the lophodont type. It is consistently maintained only when the strain of impact is of moderate amount. Should the strain become excessive the lateral border of the tooth is arched inward, as first pointed out by Ryder.[3] In the presence of these strong arches or flutings the main surfaces of attrition no longer need the basal cusp supports and they disappear. This change is illustrated in Paleosyops and Limnohyus.

When a tooth becomes worn and an island of dentine appears at the summit of the cuspule it is often seen to be obliquely placed to the main cusp. This is occasionally seen in Achænodon and Mastodon and constantly in Hippopotamus. A key is in this way afforded to interpret the islands of the complex tooth of Phacochærus. Care should be taken not to be misled in applying this method of interpretation to intricate types of tooth-structure, such as Polymastodon and its allies, for in these genera there exist true cusps only (cuspules being entirely absent), and the third row of islands (when such exists) being simply a linear row of well-defined characters placed along the border of the tooth.

A tooth that has been for a long time subjected to the action of a dilute acid is entirely deprived of its enamel, and permits the superficies of the dentine to be clearly seen. It is of interest to note that the cusps upon the dentine of a tooth thus prepared, while corresponding in a general way to those on the free enamel surface, are sufficiently distinct therefrom to afford material for comparisons, and to suggest relationships of a different character from those determined by the study of the entire tooth. Thus the dentine cusps of the premolars of Sus suggest the form of the corresponding teeth in Monachus and of Mesonyx. The cusps of the third molar of Sus are strikingly like the molars of the Insectivora and of lower molars of the genus Bathyopsis. In like manner the dentinal surface of an aberrant molar tooth of man presents the essential features of teeth so remote as to recall the type seen in Centetes, Gymnura,[4] Chrysochloris, as well as in the numerous ancestral types described by Cope from the North American Eocene.[5]

A practical method of studying teeth with the object in view of

[1] Proc. of Acad. of Natural Sciences, 1878, 45.

[2] Les Enchainements du Monde Animal, Paris, 1878, 70.

[3] Loc. cit.

[4] The arrangement seen in Sus is the same essentially as in Gymnura. The minute cuspule on the crown of the first upper molar is in precisely the same position as in Sus and, indeed, answers to it in every respect in the description of Mr. Dobson except that it is not connected to the anterior inner cusp as named by that author. It is a little curious that the dental formula of Gymnura is the same as in Sus.

[5] Report U. S. Geo. Sur. of Territory, III, 1884.

determining lines of descent is thus presented. The enamel organ of generalized types it would seem furnishes groups of characters which are probably secondary in value (since the several parts of the organ indicate wide ranges of variation and of great adaptivity) to[1] those yielded by the modulations of the surfaces of the dentine.—*Harrison Allen.*

An Extraordinary Human Dentition.—A gentleman living in Charles City, Iowa, recently exhibited to me the following remarkable dentition. To name the teeth from their forms, the formula would be as follows: I. $\frac{5}{4}$; C. $\frac{1}{2}$; Pm. $\frac{2}{0}$; M. $\frac{3}{3}\frac{3}{4}$. By position the formula would read thus: I. $\frac{5}{4}$; C. $\frac{1}{1}$; Pm. right side $\frac{2}{1}$; left side, $\frac{2}{\text{mol. temp. 2}}$; M. $\frac{3}{3}$. The first true molars in both jaws have a small accessory lobe on the inner side of the anterior inner tubercle. A brother of this gentleman has the following dental formula: I. $\frac{4}{4}$; C. $\frac{1}{1}$; Pm. $\frac{2}{1}$; M. $\frac{3}{3}$. A sister presents the following: I. $\frac{3}{3}$; C. $\frac{1}{1}$; Pm. $\frac{2}{1}\frac{2}{2}$; M. $\frac{3}{3}$. A grandmother has the incisors $\frac{5}{4}$.—*E. D. Cope.*

Zoological News.—*Echinodermata.*—H. Ayers, who has studied the sphæridia of Echinoids both at Cambridge and Banyuls, asserts (Quart. Jour. Mic. Sci., Nov., 1885) that these organs have great specialization of parts, especially of the nerve-cells, and that, as before considered probable by Lovén, the evidence at present is in favor of the view that they have the combined functions of taste and smell. Sounds do not appear to affect the sphæridia in the least, while the spines and pedicellariæ are at once affected, and the adjacent spines direct themselves toward the source of sound.——During the *Talisman* expedition fifty-four species of starfish were found, some from more than 4000 meters. Thirty-five of these species are new, and afford instructive combinations of characters.

Mollusca.—Paul Pelseneer (Quart. Jour. Mic. Sci., Oct., 1885) describes the cephalic appendages of Clione, Clionopsis and Pneumodermon. From this it appears that all these genera have two pairs of tentacles, the posterior with eyes; and that Clione and Pneumodermon are also possessed of buccal appendages, which in the latter genus are provided with suckers. The tentacles are probably homologous with those of ordinary gastropods. ——Professor Ray Lankester calls attention to the fact that sixty-

[1] The more simple forms of teeth, such as those of the molar series of the peccary, show scarcely any differences between the enamel and the dentine surfaces, and it may be reasonably expected that the greatest contrasts will be seen in the teeth which present on the enamel the largest number of cuspules and cingula which bear rows of mammilations. The position of all small cusps between the four principal cusps of the bunodont molar, is either directly between the cusps or placed obliquely to them. When in the position first named they represent the highest degree of specialization attained by the molars of the carnivores, or they exhibit a tendency toward the development of the transverse ridge of the tapirodont type of tooth. When in the position last named the cuspule described above leads to the oblique crest seen in Palæotherium and its allies.

five years ago Mr. Benj. Gaillou made known the fact that the green coloring of the European oyster (*O. edulis*), is due to the fact that it feeds upon a diatom, the *Navicula ostrearia* Gaillou. This has been persistently ignored by the advocates of the copper theory, possibly because of the peculiar blue-green of the gill lamellæ, etc., of the oyster. The Navicula in question contains a blue-green pigment diffused through its protoplasm. This pigment is absorbed by the blood of the oyster from the contents of its alimentary canal, and collected by certain secretive cells which are limited to the surface of the branchiæ and the adoral face of the labial tentacles.

Arthropoda.—J. S. Kingsley contributes to the Quart. Jour. Mic. Science (Oct. 1885), some notes on the embryology of Limulus. He regards Limulus as an arachnid, but states that it takes us back to a time when the distinctions between the Crustacea and Arachnida were far less marked than now. He also describes the outlet in the embryo of the brick-red glands.——From an article in the Quart. Jour. Mic. Science, by Professor A. Sedgwick, it appears that there are two species of Peripatus, *P. capensis* and *balfouri*. The latter has eighteen pairs of fully developed legs, and is of smaller size than the better known species. The male organs of Peripatus are a couple of blind tubes, united near their termination. It does not appear that any portion can be extruded, and the spermatophores seem to be deposited upon any part, even on the head, of the female. Yet the uterus of the female, consisting of two tubes closely applied, is always full of embryos.

Fishes.—Dr. J. Beard gives, as the result of a continued study of the branchial sense organs in the Ichthyopsida (Quart. Jour. Mic. Sci., Nov. 1885), the conclusion that ***at present we are acquainted with no invertebrate nervous system which is built upon the same plan as that of vertebrates.***

Birds.—Dr. Hans Gadow has examined the three species of Rhea. The long-billed appearance of *R. macrorhyncha* is due less to a larger, stronger bill than to a narrower and more slender skull. The three species have each thirty-three vertebræ from the atlas to and including the first primitive sacral vertebra, but *R. macrorhyncha* has one cervical vertebra more and one lumbar less than the other species. *R. darwini* is restricted to Eastern Patagonia and Southeastern Argentina; *R. macrorhyncha* to the provinces of Pernambuco and Bahia; while *R. americana* ranges from Bolivia and Matto Grosso to Uruguay, but does not seem to occur in the south-eastern provinces of Brazil. In *R. darwini* the neck is shortest, the forelimb longest, the toes longest, the bill shortest, the scutes on the metatarsus fewest. This is thus the most distinct species, yet the long neck and slender head of *R. macrorhyncha* are sufficient to distinguish it.——Mr. Sclater has described a new Phasianus from Northern Afghanistan. The wings have a patch of white, and the feathers of the belly are broadly tipped with bright purplish-black.——The third list of birds collected in Ecuador by M. Stolzmann contains twelve new species. L. Taczanowski and Count Berlepsch contribute the article (P. Z. S., 1885), and the latter appends some general considerations on the ornithology of Western Ecuador. This fauna now includes 468 species, besides eighty-five from Pichincha, Nanegal and Quito. Eastern Ecuador must be richer in birds, since Messrs. Sclater and Salvin state that Mr. Buckley collected nearly 800 species there. It also appears that there are but few species peculiar to Ecuador as a whole.——It appears from a note of Professor Owen, that the heart of the Apteryx has characters resembling those of Ornithorhynchus. This is especially the case with the auriculo-ventricular valve.

EMBRYOLOGY.[1]

THE DEVELOPMENT OF ANURIDA MARITIMA GUERIN.—During the latter part of the summer of 1883 I had good opportunities to study the development of this interesting insect at Wood's Holl, Mass., where I found its ova, together with the parent insects, in great numbers under stones along the beach just below high-water mark. This appears to be the same species as is mentioned by Dr. Packard in the U. S. Fish Commission report for 1871 and '72, p. 544. The observations which I have been able to make relate entirely to such changes in the egg as may be noted with reflected and transmitted light, as I did not prepare sections of the eggs at the time. The accompanying plate represents several stages of the development of this type, and I have also figured the adult so that it may be compared with the genera Achorutes, Lipura, Anura, etc., to which it is obviously very nearly allied.

The adults are bluish-gray, and measure about 2.25^{mm} in length; ocelli ten, five on each side; no spring or elater developed in the full-grown insect.

The eggs are quite opaque, or practically so when observed with transmitted light, and measure .36 of a millimeter in diameter. They are dirty yellow in color and not white as are the eggs of Isotoma described by Dr. Packard in his memoir[2] on the development of that genus.

When the young Anurida first leaves the egg it strongly resembles Achorutes in the form of its body, as may be gathered from Figs. 3 and 4, and like the adults of that genus is whitish in color. The bluish, velvety appearance of the integument or cuticula which characterizes the adult does not appear to be developed until some days after hatching, or until one or more ecdyses have been accomplished. The eggs of this species are

[1] Edited by JOHN A. RYDER, Smithsonian Institution, Washington, D. C.

[2] Embryological studies on Diplax, Perithemis and the thysanurous genus Isotoma. Mem. Peabody Acad. Sciences, Vol. 1, No. II, 1871, pp. 15–21, plate 3.

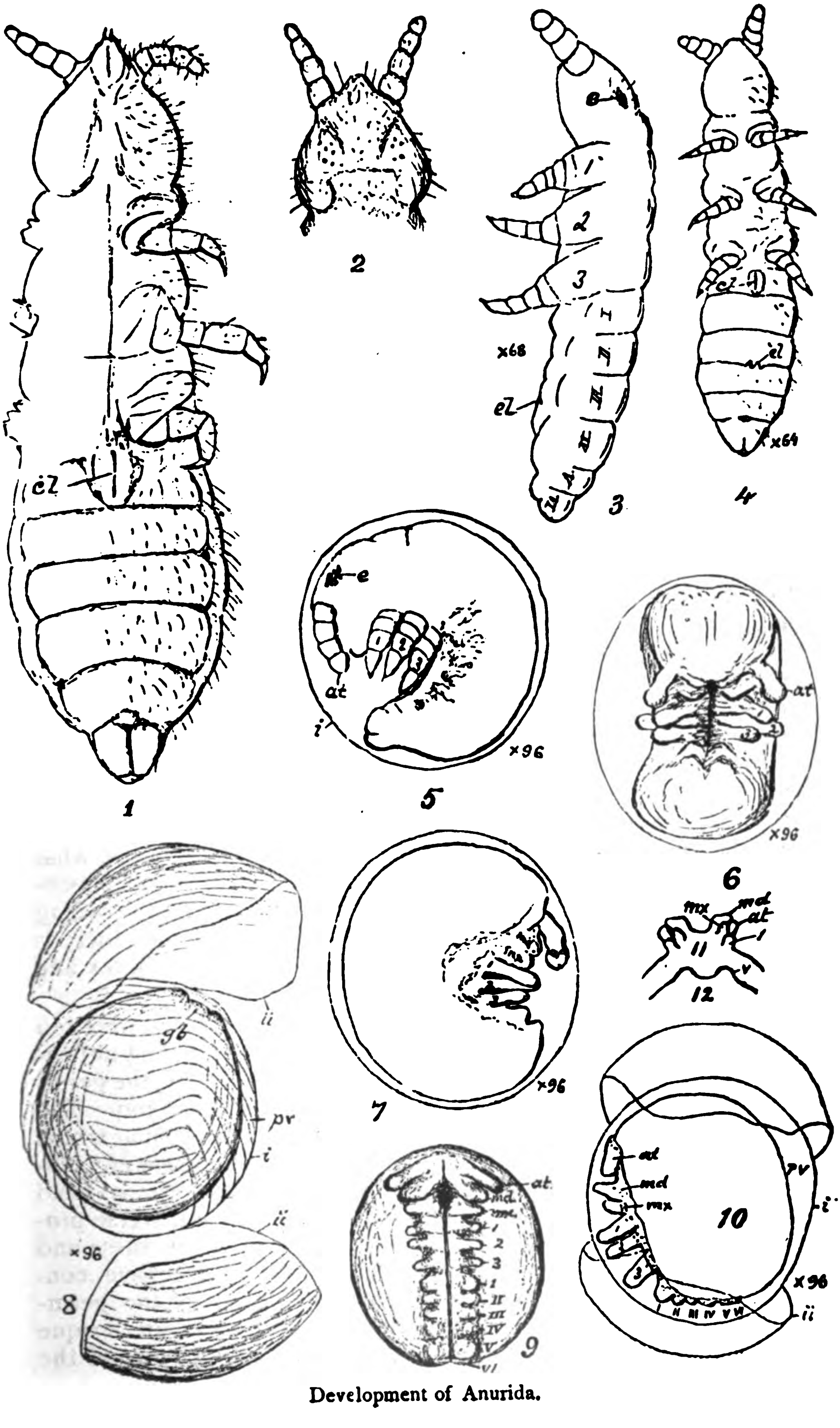
also over twice the diameter of those of Isotoma, which measure only about .15 of a millimeter in diameter, so that there is more yolk present and development is much more extremely mero-blastic or decidedly epicyemate in character. This will be evident if Figs. 9, 10, 11 and 12 are compared with the earliest stages of Isotoma figured by Packard in the memoir just cited.

One feature in the development of Anurida which has interested me greatly is the presence of a very rudimentary spring or elater, *el*, shown from below in Fig. 4 and from the side in Fig. 3. This appendage, which probably represents a pair of degenerate limbs, is produced from the anterior, inferior part of the fourth abdominal segment, but on the ventral side of the adult no sign of its presence is visible, as may be gathered from an examination of Fig. 1. This organ in Anurida does not arise from the penultimate segment, as in Isotoma, as stated by Packard, but from the antepenultimate or fourth abdominal segment which is in reality the one from which the elater arises in such genera of Collembola, as Lepidocyrtus, Triæna, Tomocerus, etc. In the just-hatched larval Anurida, the elater is developed to exactly the same degree as in *Triæna mirabilis* Tullb., according to Brook.[1] The inference, therefore, is that the springless genera of Collembola are degenerated forms which have descended from others which were provided with well-developed elaters. In fact it is now possible to trace the gradual degeneration of the elater through the genera Achorutes, Xenylla, Triæna and the young of the species under consideration here. Linking this series with those having a more developed elater and tenaculum, and these again with such forms as Campodea and Machilis, we realize what a remarkable series of differential changes the abdominal appendages of the Thysanura and Collembola have undergone, starting probably from the still less modified Symphyla, in which there is no differentiation even between the appendages of the thorax and abdomen.

The earliest stages were not considered, as the ova were too opaque to be studied by transmitted light, and the earliest intimation of the formation of the germ is shown in Fig. 8 at *gb*, the germ-band being viewed in profile transversely or from one end. The germ-band or ventral plate forms a pronounced thickening which lies on one side of the vitellus, with its longest diameter coinciding with the longer diameter of the egg. This germinal band soon becomes widest anteriorly, as shown by the transverse profile views of it represented by Figs. 11 and 12. From these and a lateral profile view (Fig. 10) of the same stage, I have constructed the diagrammatic representation (Fig. 9) of the germ-band as it would be seen by reflected light, or as an opaque object, extending over very nearly a semicircumference of the

[1] Journ. Linn. Soc. London, XVII, 1882, pp. 21–22, pl. 7, figs. 11 and 12.

PLATE XV.



Development of Anurida.

vitellus. In the later profile (Fig. 10) the germ-band shows the appendages of the embryo developed as follows: the antennæ *at*, the mandibles *md*, the maxillæ *mx*, the three pairs of legs, *1*, *2* and *3*, the collophoral segment, I, and the following abdominal segments up to VI. In the next stage, when it may be said that the embryo is already beginning to lengthen, as shown in Fig. 7, the ventral plate, with its appendages, is no longer convex when viewed laterally in profile, but becomes strongly concave or bent upon itself, and it then appears as if it had been shortened, the embryonic appendages being also much crowded together at their distal ends, as shown in Figs. 6 and 7, which represent the same stage viewed from in front and in profile. In the course of further development the embryo increases still more in length, as shown in Fig. 5, when it may be said that the definitive form of the parent animal begins to be obvious. By this time the limbs and antennæ have become definitely segmented. During the earlier stages the limbs, antennæ, collophore, etc., had the form of mere blunt, paired papillæ, or of blunt, clavate, tentacle-like paired outgrowths from the lateral surfaces of the ventral plate or elongated germinal area.

The changes which determine the appropriation of the yolk, or whether a dorsal organ is developed which takes part in this or not, as held by Korotneff in the case of Gryllotalpa, are points which have not been made out. This, as well as the manner in which the blastoderm is formed, can only be made out by means of sections.

The eggs, as well as the adult animals, are not readily wetted with water or even in dilute alcohol. I have succeeded in hardening them by treating them first with weak alcohol and afterwards placing them in dilute chromic acid or Müller's fluid.

The egg of this species, after the formation of the germinal plate, is invested by an inner covering, *i*, and an outer one, *ii* as shown in Figs. 8 and 10. By very careful manipulation under a compressor the outer one may be ruptured, when it will be discovered that the inner one is wrinkled in the most singularly symmetrical fashion, as represented in Fig. 8. Whether this second wrinkled covering is the serous envelope or amnion I am not certain. It may be that it is a cuticular chitinous secretion from the cells of the blastoderm, such as has been found by Kingsley[1] to invest the embryo of Limulus while yet in the egg. Inside the second egg-envelope, and between it and the ovum proper, there is a very considerable perivitelline space, *pr*, developed.

Imperfect as these notes are, I publish them, first, because the development of this form differs greatly in its external features from that of Isotoma, described by Packard; secondly, because the development of this type recapitulates very briefly the devel-

[1] Notes on the embryology of Limulus. Quart. Journ. Mic. Sci., Oct., 1885.

opment of the elater, so characteristic of the Collembola, indicating, as it seems to me, that that organ, in the genera in which it is absent or rudimentary, has been lost through degeneration; and thirdly, because the egg is more decidedly meroblastic or teleplasmic than that of Isotoma.—*John A. Ryder.*

PHYSIOLOGY.[1]

REPORT OF COMMITTEE ON DISINFECTANTS OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.—A little more than a year ago the Public Health Association, stirred up by the prospective speedy advent of cholera in this country, took steps to arm both practitioners of medicine and the public at large against not only that disease but all ailments supposed to owe their existence to "germs." A committee was appointed consisting of Drs. Sternberg and Smart, of the Army, Raymond, of Brooklyn, Vaughan, of Ann Arbor, Leeds, of New Jersey, Watkins, of New Orleans, and Rohé, of Baltimore, to investigate the efficiency of the various obtainable germicides and antiseptics in respect to sanitation and preventive medicine. Probably no more competent and conscientious workers than are some, if not all of the members of this committee, could have been chosen to carry out this difficult undertaking. The report opens by clearing away a common confusion of terms. An *antiseptic* is a substance which simply prevents or arrests the development of bacterial organisms; a *disinfectant* or *germicide* is a substance which kills them. All disinfectants are antiseptics, but not all antiseptics are disinfectants. The work of the committee was limited to the study of the disinfecting properties of the substances investigated.

The report consists partly of the descriptions of original experiments, and partly of historical essays, embodying the results of the most trustworthy investigators in this field. The general reader would search in vain the mass of bacteria literature to find some definite idea of the comparative value of different disinfectants; but in the work before us the confusion is reduced to a minimum, because the many different substances investigated are considered from the same standpoint and after the same methods. It means very little when one experimenter declares that chromic acid, for example, is an antiseptic in the proportion 1 : 1000, and another that carbolic acid has the same power when of the strength 1 : 500; for the more concentrated the strength of the germ-food solution the greater must be the concentration of the antiseptic to be efficient, and a percentage of antiseptic, that would prevent the development of germs for the space of three days, might be lived down by bacteria in the course of six.

Mercuric chloride as a disinfectant easily stands at the head of substances readily obtainable. As this substance is a violent

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.

poison objection has been made to its use that when thrown into vaults it might soak through the earth and contaminate the drinking water in wells or cisterns; Dr. Vaughan, however, has shown that when solutions of mercuric chloride are filtered through various kinds of soil, the filtrate contains no trace of mercury; the bichloride having probably been decomposed in the earth, the mercury forming insoluble salts with carbonates and phosphates with which it has come into contact. Its destructive action on lead pipes presents one important objection to the domestic use of the mercury salt. Some bacterial organisms reproduce themselves by means of spores, and these latter are very much more resistant toward germicidal influence than are the active organisms. The conclusions arrived at by the committee are of so great practical importance and are so concisely stated that they will be stated here nearly *in extenso.*

The most useful agents for the destruction of spore-containing infectious material are: 1. *Fire.* Complete destruction by burning. 2. *Steam under pressure.* 110° C. (230° Fahr.) for ten minutes. 3. *Boiling in water* for one hour. 4. *Chloride of lime.* 1 to 4 per cent solution. 5. *Mercuric chloride.* A solution of 1 : 500.

For the destruction of infectious material which owes its infecting power to micro-organisms *not containing spores,* the committee recommends: 1. *Fire.* Complete destruction by burning. 2. *Boiling in water* half an hour. 3. *Dry heat.* 110° C. (230° Fahr.) for two hours. 4. *Chloride of lime.* 1 to 4 per cent solution. 5. *Solution of chlorinated soda.* 5 to 20 per cent solution. 6. *Mercuric chloride.* A solution of 1 : 1000 to 1 : 4000. 7. *Sulphur dioxide.* Expose for twelve hours to an atmosphere containing at least 4 volumes per cent of this gas, preferably in presence of moisture (this requires the combustion of 3 to 4 lbs. sulphur for every 1000 cubic feet of air space). 8. *Carbolic acid,* 2 to 5 per cent solution. 9. *Sulphate of copper,* 2 to 5 per cent solution. 10. *Chloride of zinc,* 4 to 10 per cent solution.

The committee would make the following recommendations with reference to the practical application of these agents for disinfecting purposes:

For excreta.—(*a*) In the sick room: For spore-containing material. 1. Chloride of lime in solution, 4 per cent. 2. Mercuric chloride in solution, 1 : 500 (the addition of an equal quantity of potassium permanganate as a deodorant and to give color to the solution is recommended). In the absence of spores; carbolic acid in solution, 5 per cent. 4. Sulphate of copper in solution, 5 per cent. 5. Chloride of zinc in solution, 10 per cent. (*b*) In privy vaults; mercuric chloride in solution, 1 : 500. Chloride of lime in powder (it is well to dilute by mixing with plaster of paris or clean sand).

For clothing, bedding, etc.—(*a*) Soiled underclothing, bed linen, etc. 1. Destruction by fire, if of little value. 2. Boiling for at least half an hour. 3. Immersion in solution of mercuric chloride of strength 1 : 2000 for four hours. 4. Immersion in a 2 per cent solution of carbolic acid for four hours. (*b*) Garments which would be injured by the above treatment: 1. Exposure to dry heat at a temperature of 110° C. (230° Fahr.) for two hours. 2. Fumigation with sulphurous acid gas for at least twelve hours, the clothing being freely exposed and the gas present in the disinfection chamber in the proportion of 4 volumes per cent. (*c*) Mattresses and blankets soiled by the discharges of the sick: 1. Destruction by fire. 2. Exposure to super-heated steam—25 lbs. pressure—for one hour (mattresses to be freely opened). 3. Immersion in boiling water for one hour. 4. Immersion in solution of mercuric chloride and sulphate of copper.

Furniture and articles of wood, leather and porcelain, washing, several times repeated, with: 1. Solution of mercuric chloride 1 : 1000. 2. Solution of chloride of lime, 1 per cent. 3. Solution of carbolic acid, 2 per cent.

For the person.—The hands and general surface of the body of attendants, of the sick and of convalescents at the time of their discharge from the hospital: 1. Solution of chlorinated soda 1 to 9 of water. 2. Carbolic acid, 2 per cent solution. 3. Mercuric chloride 1 : 1000; the latter recommended only for the hands or for washing away infectious material from a limited area, not as a bath for the entire surface of the body.

For the dead.—Envelope the body in a sheet thoroughly saturated with: 1. Chloride of lime in solution, 4 per cent. 2. Mercuric chloride in solution, 1 : 500. 3. Carbolic acid in solution, 5 per cent.

Recent Investigations on the Respiratory Center.—Our knowledge of the respiratory center dates from the work of Le Gallois, in the early part of this century. He located this center in the medulla oblongata, confining it indeed to a very limited portion of the medulla in the region of the origin of the vagus nerve. Flourens repeated Le Gallois's experiments and localized the center to a small spot in the gray matter at the level of the calamus scriptorius which he named the "nœnd vital." Later workers demonstrated that the respiratory center of the medulla is bilateral. Longitudinal sections along the middle line of the medulla do not prevent the respiratory movements from taking place. No part of physiology seems to have been more generally accepted than the existence of this center in the medulla, though its exact position has always been and is still a matter of controversy. In 1873 Gierke made a thorough investigation of the subject, his method being to make lessons of different portions of the medulla, as narrowly localized as possible; and after observing the effects of his section to harden the medulla and study the lesion by means of microscopic sections. He found that destruction of a small area in the region of the end of the calamus scriptorius on both sides was followed by a complete cessation of the respiratory movements. Microscopic study of this region convinced him that the spot whose destruction had this effect was a bundle of nerve fibers lying outside of the nucleus of the spinal accessory nerve and below the nucleus of the posterior pyramid. This result was of course very unsatisfactory. According to the present conceptions of physiologists nerve centers must always consist of nerve cells, and it is not conceivable that automatic stimuli can arise in nerve fibers. If investigations had rested here this collection of fibers could only be looked upon as the efferent fibers from a center whose location had not yet been determined.

Other physiologists have denied the existence of a respiratory center in the medulla, altogether holding that the centers governing the respiratory movements are situated in the spinal cord. While others have described respiratory centers in the floor of the third ventricle, or in the corpora quadrigemina in the gray matter surrounding the aqueduct of Sylvius. Two interesting communications on this subject have appeared recently in the Centralblatt f. Med. Wiss., Nos. 27 and 34, 1885. Unfortunately these investigations have given different results, so that we are still left in doubt as to the location of the medullary center, though it looks as if the problem was very near its final solution. The first communication, No. 27, is by Mislawsky. He states that Gierke's bundles have nothing to do with the respiratory movements. Injury to them in any part of their course does not prevent respiration. He localizes the respiratory centre in a number of nerve cells forming an irregular group on either side of the raphe, lying between it and the root of the hypoglossal nerve. The boundaries of this center lie between the base and point of the calamus scriptorius, from before back, and in a dorso-ventral direction between the olives and the gray substance of the floor of the fourth ventricle. Destruction of this centre on both sides completely stops the respiratory movements, while injury to one side affects the respiratory movements of that side alone. The efferent fibers from this center to the spinal origin of the nerves of the respiratory muscles lie outside of Gierke's bundle. In No. 347 of the Centralblatt, Gierke replies to Mislawsky's criticism. He states positively that the group of cells described by Mislawsky as the respiratory center does not exist; that the locality assigned to it is occupied entirely by the reticular formation, and it is the scattered cells of this formation which Mislawsky has mistaken for a definite nerve center. The disposition of the nerve cells in the reticular formation he finds to be very irregular in different mammalia, and in no case was there any collection of these cells that could be differentiated from the remaining cells of the formation.

Gierke states that his latest investigations have convinced him that the bundle of fibers previously described by him as the respiratory center contains in its whole extent a number of nerve cells, and these cells are in connection with the fibers of the bundles. This discovery takes away the theoretical objections to Gierke's previous results, and if his work can be corroborated will place the existence of a medullary respiratory center upon a satisfactory experimental basis.

Both communications are preliminary to more extensive papers, shortly to be published.—*W. H. Howell, Johns Hopkins University.*

PSYCHOLOGY.

INTELLIGENCE OF ANTHROPOID APES.—In his excellent work on anthropoid apes, Professor Hartman, the Berlin zoölogist maintains that anthropoid apes in nature "develop an intelligence which sets them high above the other mammals. They do not, however, display the keenness of scent and quickness of sight which distinguish some animals of a lower order, such as canine beasts of prey and ruminants manifest in many different ways. The structure of their nests is rude in comparison with that of some other mammals—as for example, of rodents. But we must not forget that several of the lower races of men, such as the degraded Bedja, the Obongo, the Fuegians, many aborigines of the Brazilian forests and the Australian black, scarcely rise above the inartificial structure of an anthropoid's nest in the construction of their huts."

The author quotes Falkenstein's description of a gorilla: "His good-humor and shyness, or rather roguishness, deserves special mention as his strongest characteristic. When he was chastized, as it was necessary to do at first, he never resented the punishment, but came up with a beseeching air, clinging to my feet, and looking with an expressive air which disarmed all displeasure. When he was anxious to obtain anything, no child could have expressed its wishes in a more urgent and caressing manner. If in spite of this he did not obtain what he wanted, he had recourse to cunning, and looked anxiously about to see if he was watched. It was just in these cases when he obstinately pursued a fixed idea, that it was impossible not to recognize a deliberate plan and careful calculation. If, for example, he was not allowed to leave the room, or, again, was not allowed to come in, he would, after several attempts to get his own way had been baffled, apparently submit to his fate, and lie down near the door in question, with assumed indifference. But he soon raised his head in order to ascertain whether fortune was on his side, edging himself gradually nearer and nearer, and then, looking carefully round, he twisted himself about until he reached the threshold; then he got up, peered cautiously round, and with one bound galloped off so quickly that it was difficult to follow him.

"He pursued his object with equal pertinacity when he felt a desire for the sugar or fruit which was kept in a cupboard in the eating-room; he would suddenly leave off playing and go in an opposite direction, only altering his course when he believed that he was no longer observed. He then went straight to the room and cupboard, opened it, and made a quick and dexterous snatch at the sugar-box or fruit-basket, sometimes closing the cupboard doors behind him before beginning to enjoy his plunder, or, if he was discovered, he would escape with it, and his whole behavior made it clear that he was conscious of transgressing into forbidden paths. He took a special, and what might be called a childish pleasure in making a noise by beating on hollow articles, and he seldom omitted an opportunity of drumming on casks, dishes or tin trays, whenever he passed by them—a noisy amusement to which he was much addicted during our homeward voyage on board the steam-vessel, in which he was at liberty to roam about.

"Mafuca, for a while, was pleased with the companionship of a pretty sea-cat monkey, but she teased the creature so much that a special refuge was set apart for it, into which she could not enter. She was so scared and terrified by a heavy thunder-storm that she seized her sleeping playfellow by the tail and dashed it to the ground. She chased the mice which ran about the cage with deadly fury. She was much afraid of snakes, which is not usually the case with chimpanzees. If she was left alone any time she tried to open the lock of her cage without having the key, and she once succeeded in doing so. On that occasion she stole the key which was hanging on the wall, hid it in her axilla and crept quietly back to the cage. With the key she easily opened the lock, and she also knew how to use a gimlet. She would draw off her keeper's boots, scramble up to some place out of reach with them, and throw them at his head when he asked for them. She could wring out wet clothes and blow her nose with a handkerchief. When her illness began, she became apathetic, and looked about with a vacant, unobservant stare. Just before her death, from consumption, she put her arms round Schöpf's neck when he came to visit her, looked at him placidly, kissed him three times, stretched out her hand to him, and died. The last moments of anthropoids have their tragic side."

Dr. Preyer's Criticism of Telepathy.—Professor Preyer, of Jena, well known through his researches into hypnotism, the development of the infant mind, etc., does not believe in telepathy, and attempts in a twenty-page article to give the readers of the January *Rundschau* the reasons for his skepticism. His criticisms are confined to the Proceedings of the Society for Psychical Research in London, which in September, 1882, numbered 100, and a year ago 520 members, including 140 women. With truly German contempt for the feminine intellect, Dr. Preyer remarks that "the large number of female members and participators shows at the very outset that a strictly scientific spirit cannot be regarded as underlying the society's proceedings." But since the society has assumed such large dimensions as to have its special headquarters and a library, and since it includes among its active or honorary members such names as Balfour Stewart, Lord Rayleigh, Professor Bowditch, Mr. Crookes, and Mr. A. R. Wallace, Preyer thinks it worth while to examine their proceedings critically, so as to caution his countrymen against these useless proceedings, and prevent, if possible, the formation of a similar society in Germany. Preyer's analyses of a number of the 600 reported cases of telepathy are exceedingly ingenious and subtle. Though he concedes that the *possibility* of thought transference cannot be disproved, he makes out a good case that the experimenters ignored sources of error which vitiate their conclusions. Especially ingenious is his explanation of the countless ways in which the two persons to be examined can communicate with each other, if in the same or adjoining rooms—as by means of different noises made in breathing through the mouth or nose, movements with the foot, gnashing of the teeth, etc.; remembering at the same time that individuals, owing to great nervous susceptibility or to training, are endowed with as abnormal acuteness of the senses as are hypnotized persons. In Liverpool, for example, two girls were examined who claimed that one could tell what the other ate, if the latter was allowed to put her hand on the former's shoulder. Aside from the fact that there might have been a prearranged alphabet of signs through pressure on the shoulder, there was the probability that one of the girls had a very acute sense of smell. The result showed that in thirty-two trials only six answers came out correct, and in five of these cases the substance used had a strong odor. In other instances, where one of the persons under examination puts the question himself to the other, Preyer points out that the whole secret may be betrayed by special accents placed on certain words, in the same way that dogs can be taught to pick out certain cards, to add and subtract, by emphasizing certain words. The cases of alleged action of one mind on another, at greater distances, Preyer regards as either due to coincidence, to fraud, to hallucinations, to incorrect reporting, or to lack of accurate observation, which, always difficult, is more especially so in the region of psychic phenomena. In conclusion, he points out that savages ascribe nothing to chance, while with progressive civilization we see more and more how many that appear to be related as cause and effect are mere coincidences.—*The Nation.*

MENAULT'S INTELLIGENCE OF ANIMALS.[1]—This is a very readable and pleasantly illustrated book, filled with anecdotes of animals of all grades, from ants to apes. When the original book appeared we do not know, but in his accounts of ants, Menault does not mention the recent writings of Forel, Lubbock or McCook;

[1] Wonders of Man and Nature. The Intelligence of Animals, with illustrative anecdotes. From the French of Ernest Menault. Illustrated. New York, Charles Scribner's Sons, 1885, 12mo.

and in other portions Morgan's work on the beaver, or Romanes' excellent book do not seem to have been known to the author or his translator. Indeed the authors quoted are largely French, though the recent remarkable papers and books of Favre are not referred to. The book is not therefore to be classed with the more critical and authoritative works of the authors which we have named, though it is a very interesting collection of anecdotes which throw more or less light on the mental powers of animals, particularly of those domesticated by man. The cuts are attractive, but that of the "chimpanzee at table," carving with a knife and fork, and filling his glass from a bottle held *in a tight coil of his tail*, represents a creation of the studio rather than a result of the processes of evolution *in re* tails.

ANTHROPOLOGY.[1]

ANNUAL REPORT OF THE BUREAU OF ETHNOLOGY.—The third annual report of the Bureau of Ethnology, covering the fiscal year 1881–'82, and bearing the imprint of 1884, has just appeared. The volume consists of the report of the director, Major J. W. Powell, and scientific papers by Thomas, Dall, Matthews, Dorsey, Holmes and Stevenson.

Major Powell's report reviews the work of the Bureau in the field and in the office, epitomizes the scientific papers in the volume, and closes with a very suggestive chapter on activital similarities. The resemblances which have been noticed in human arts and inventions throughout the world arise, according to the essay, in the four following ways:

Autogenous similarities	Due to concausation. Adventitious.
Syngenous similarities	Due to cognation. Due to acculturation.

That is, things may arise independently from similar causes; they may be similar merely by accident; they may have come about through the same race or their descendants; or one people may have learned them from another.

The chapter concludes with nine rules, for the discovery of which one of the causes has been active in any case.

Mr. Thomas' paper, entitled Notes on certain Maya and Mexican Manuscripts, is a comparison of two plates in the Codex Cortesianus with the Mexican calendar systems to show the connection between the two. The author says: "That all the Central American nations had calendars substantially the same in principle as the Mexican, is well known. This of itself would indicate a common origin not so very remote; but when we see two contiguous or neighboring peoples making use of the same conventional signs of a complicated nature, down even to the most minute details, and those of a character not comprehensible by

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

the commonalty, we have proof at least of a very intimate relation. One thing is apparent, viz., that the Mexican symbols could never have grown out of the Maya hieroglyphics. That the latter might have grown out of the former is not impossible."

Mr. Dall's paper treats of masks, labrets and certain aboriginal customs, with an inquiry into the bearing of their geographical distribution. His classification of masks is as follows:

1. The mask, having breathing and peep holes.
2. The maskette, without perforations.
3. An object resembling a mask, but not to be worn.

In an evolutionary series masks would be arranged thus:

A. For defense.
  a. Passive, culminating in the helmet.
  b. Active, awe inspiring, culminating in shaman masks.
B. Symbolical.
  a. Illustrative.
  b. Ritual.

The author, after a very elaborate treatment of the subject, illustrated by numerous figures, closes with some observations upon the origin of labretifery and mask-wearing in America, which apparently called forth Major Powell's essay on activital similarities. Rejecting Northern Asia and the Atlantis theory, holding as extremely improbable the theory of similar causes acting to produce similar effects, Mr. Dall concludes that the great congeries of islands, known as Polynesia and Melanesia, offer the most plausible solution of the problem.

Dr. Matthews has a short paper beautifully illustrated and perfect of its kind. That is to say, the author has described the Navajo weaver so accurately and minutely that any hand-loom weaver could read the description and produce a Navajo blanket or belt. It is so refreshing to read a description of aboriginal art by one who knows aught about it that, even at the risk of flattery, we cannot refrain from the foregoing just encomium.

There are three kinds of Navajo blankets in the National Museum. The first, or oldest, is aboriginal work, from the raw, dirty, native wool to the finished robe. This the author describes. The second is partly native and partly of raveled strouding or traders' blankets. The third is a modern invention. Germantown wools, not always well dyed, are furnished to the weaver, and he executes patterns to order. These, though held at high price, are inferior in every way; the colors fade, and run if wet in the least.

Mr. Dorsey's paper on Omaha sociology, the longest in the volume, is also the most elaborate and the most learned. The author discusses the social system of the Omaha tribe of the great Sioux stock in the following order:

1. The state, its classes and corporations.
2. The Gentile system, including tribal circles, sacred tents, sacred pipes, the several gentes minutely described.
3. The kinship system and marriage laws, giving classes of consanguines, the laws of marriage and remarriage.

4. Domestic life, courtship, marriage customs, etiquette, bashfulness, pregnancy, children, position of women, catamenia, widows and widowers, rights of parents, personal habits, politeness, meals, etc.
5. Visiting customs.
6. Industrial occupations, hunting, fishing, agriculture, food, clothing, etc.
7. Defensive and offensive warfare.
8. Games, societies, corporations, etc.
9. The government and religion.
10. Law.

Mr. Holmes' article treats of prehistoric textile fabrics in the United States, derived from impressions on pottery. The process of Mr. Holmes is most ingenious. He takes a cast of the fragments of pottery and that brings out the texture of the cloth or basket by which the soft paste was impressed. It is marvelous that no other archæologist ever thought of this effective scheme. In the application of his casts to modern weaving Mr. Holmes will allow a suggestion. His first group and his fourth group are the same, the one being plain, checker weaving, the other, weaving in diagonal or diaper. His second group and his third group are absolutely identical, appearing on the same piece in many modern examples. His elaborate schemes of weaving this pattern are also unnecessary, the warp being mistaken for the weft, and very complicated machinery substituted for a stick set up in the ground, as any one may see who will visit the basket makers in Queen Charlotte archipelago.

Group five may represent four-ply braiding, but it is just as likely to belong to group two, although the Tlinkits understand four-ply braiding.

We may be allowed a word as to the spread of textile industry at present among the North Americans in its relation to Mr. Holmes' paper. Types one and four are practiced by all Indians east of the Rocky mountains, north and south. If Mr. Holmes' figs. 65, 107, 108 and 109 are coiled basketry (and they look very much like the Pai Ute pitched water jars) this style is still practiced by the North Carolina Cherokees, and by the Eskimo, Athapascan, Californian, Pueblo, Apache, Navajo, Yuma and Pima tribes. Mr. Homes' twined ware, groups two and three, is made now by the Winnebagos east of the Rockies, and by the Eskimo, Tlinkit, Haida and Chimsyan tribes as well as by those of Washington Territory, Oregon, Northern California, and by the Shoshonis and Pueblo tribes. It is not now known among any of the tribes who have of late been identified with the mound-builders.

The illustrated catalogues at the end of the volume are extremely useful to the student. The practice of printing a great mass of numbers, conveying no information, which very much marred Vol. II of these reports, has been less followed here. The illustrations of the volume, especially those last executed, are excellent, and the appearance of the whole work does credit to the editor in charge.

The Crania of Negroes.—Although published in 1884, C. Passavant's Craniologische Untersuchung has just come to hand. His results are given both in tables and in graphic charts, the former are here combined:

Indices.	*Whole No. African crania.*	*Hottentots and Bushmen.*	*Kaffirs.*	*Congo.*	*Nigritians.*	
64	3	—	1	—	2	Dolicocephals.
65	1	—	1	—	—	
66	4	—	1	2	1	
67	3	2	—	1	—	
68	5	1	2	1	1	
69	3	—	1	1	1	
70	13	1	4	4	4	
71	15	2	6	3	4	
72	19	2	4	7	6	
73	21	4	7	5	5	
74	21	2	3	10	6	
75	27	5	8	8	6	Mesocephals.
76	24	4	2	10	8	
77	20	8	1	10	1	
78	6	1	—	5	—	
79	6	—	—	5	1	
80	6	—	—	4	2	
81	2	—	—	2	—	Brachycephals.
82	1	—	—	1	—	
83	2	—	—	2	—	
84	2	—	—	2	—	
85	1	—	—		1	
	205	32	41	83	49	

From this table it will be seen that all indices may be found in Africa, that the Congoese are the shortest headed, and that the mass of the whole or of any class will be found between 70 and 80. The same would probably be true on any other continent, showing that Dr. Topinard's application of the results of cranial index as an evolutionary characteristic is probably correct.

Lacustrian Antiquities of Dr. Gross.—Archæologists and antiquarians traveling on the European continent will be pleased to hear that the celebrated collection of *lacustrian* antiquities of Dr. Gross of Neuveville, on the Lake of Brenne, was presented by the proprietor to the Swiss confederacy, and is now on exhibition in the federal palace at Berne, the capital. All the different periods are well represented, and there are over 5000 pieces making up the collection, many of them being unique. There are one hundred objects of nephrite and jadeite, one hundred and fifty bracelets and anklets, one hundred knives, sixty hatchets, a large array of objects in silex and bronze, pottery molds, vases, and skulls from several Swiss lakes. In the same hall are suspended the two paintings of Bachelon, "Domestic Life of the Lake Dwellers." Berne also possesses a civic museum for antiquities, and other well-assorted collections of this kind may be found in Brenne, Zürich, Neufchâtel, Geneva and Freiburg.—*A. S. Gatschet.*

Recent Articles by Dr. Tschudi—We have before us a series of recent articles composed by the Peruvian traveler, Dr. J. J. von Tschudi, who at present employs himself in making digests of ethnologic material previously collected. These papers are partly of an anthropologic, partly of a topographic or linguistic import. Among the latter we mention: "Die geographischen Namen in Peru," eight pages, in *Kettler's Geographic Magazine;* "Remarks on Lopez's communication on the tribe of the Calchaqui Indians," in the Argentine Republic (Zeitsch. f. Ethnologie, 1885), in which v. Tschudi lays stress upon the total disparity of the tribe spoken of with the Kechuas in their language; "Das Lama in seinen Beziehungen zum altperuanischen Volksleben" (Zeitschr. f. Ethnologie, 1885, pp. 93–109), a very instructive treatise, based alike on history and on the author's own ethnographic and local investigation. The extensive terminology of the Indians to designate all kinds of young, old, spotted, etc., lamas is of peculiar interest to the linguist.—*A. S. Gaschet.*

Supplement to the Grammar of the Cakchiquel language.—Dr. Otto Stoll, a physician of Zürich, Switzerland, who has lived five years among the Indians of Guatemala, has written some important "Supplementary remarks to the grammar of the Cakchiquel language, edited by Dr. D. G. Brinton." This article was read before the American Philosophical Society of Philadelphia, February 6, 1885, and printed in its Proceedings. Stoll's remarks form a series of rectifications and criticisms upon the antiquated method followed by the ancient ecclesiastics in writing up grammars of the American languages, and the frequent misapplications in their terminology. As to the name Cozumelguapan, Stoll thinks it is of Nahuatl origin, and quotes the etymology of Buschmann, "Near the rainbow water." He may rest assured, that only the local ending -pa, -pan is Nahuatl, and that *cozumel* is a Maya word, signifying *swallow.*—*A. S. Gatschet.*

MICROSCOPY.[1]

Natural Injection (Leeches).—I have often noticed that leeches hardened in weak chromic acid, or in any chromic solution, are beautifully and naturally injected with their own blood. Where the circulatory system is to be studied by means of sections, this method seems to be the simplest and most reliable one. Not only the larger sinuses, but the intra-epithelial capil-

[1] Edited by Dr. C. O. Whitman, Mus. Comparative Zoology, Cambridge, Mass.

laries, may be easily traced by this method, as was first pointed out by E. Ray Lankester.[1]

METHODS OF INJECTING ANNELIDS (Maurice Jaquet).[2]—For annelids with dark tissues like Hirudo, a light-colored (white or yellow) injection-mass should be employed, while for transparent animals dark colors are preferable. Chrome yellow serves as a good coloring substance. It is easily obtained by mixing solutions of bichromate of potassium and acetate of lead. A copious yellow precipitate is formed, which should be washed on the filter, and then exposed to the air until nearly dry. The pigment, after being reduced to a pulp-like state, is added to an ordinary aqueous solution of gelatine; and the mass is then filtered warm through linen. If the injection-mass is to be blue, then the gelatine may be dissolved directly in liquid Prussian blue, and the mass filtered through the paper.

As a rule, annelids must be killed before they can be injected. Chloroform and alcohol are the means commonly employed in killing for the purpose of injection; fresh water may also be used for some marine species. A leech, for example, is placed in water containing a small quantity of chloroform; after a few moments it sinks to the bottom and remains motionless. It should be allowed to remain in the water from one to two days before attempting to inject it.

The simplest and most convenient form of syringe consists of a glass tube drawn to a fine point at one extremity, and furnished at the other with a rubber tube. Preparatory to injecting, the glass should be plunged in warm water for a few moments; then, after expelling the water, it may be filled with the injection-mass by sucking the air from the rubber tube. If the injection-mass is turned into the large end of the glass, it may happen that granules are introduced which are large enough to obstruct the narrow passage of the small end. After inserting the cannular end in the vessel, clasp both with the forceps, and then force the injecting fluid, by aspiration through the rubber tube, which is held in the mouth. When the operation is completed, place the animal in cold water, in order to stiffen the injected mass.

AN INJECTION-MASS TO BE USED COLD.—[3]

Borax (saturated solution)	1 part.
Gum arabic	2 parts.

The solutions are best made in hot water. The mixture of the solutions gives a gelatinous mass that is nearly insoluble in water. The mass is broken up into small pieces and a little water added, and then pressed through linen. A thick fluid is thus obtained, which, with the addition of a little more water, must again be

[1] Quart. Jour. Mic. Sc., xx, July, 1880, p. 306.
[2] Mitth. a. d. Zoöl., Station z, Neapel, vi, H. 3, p. 298, Dec. 1885.
[3] A. K. Bjelousson, Arch. f. Anat. u. Phys. (Anat. Abth.), 1885. H. 5 and 6, p. 379.

passed through linen. This fluid may be kept for months, and is readily thinned to any desired consistency by the addition of water. Before using, it should be tested with alcohol. A small quantity is placed in a test-tube, and then a little alcohol added. The fluid is at once changed to a solid mass of double the original volume, and this mass is insoluble in water.

Thus the whole process consists in this: that borax and gum arabic form together an insoluble colloid mass; by pressure through linen, with water added, the mass passes into a fluid condition which can be diluted to any extent with water; after injection and immersion of the preparation in alcohol, it again assumes a colloid condition in which it is insoluble in water.

The mass thus prepared may be colored with finely powdered carmine, or with other coloring substances; only cobalt and cadmium are to be avoided.

This mass is especially recommended for macroscopic injections, and for the injection of lymphatic spaces. The injected vessels do not become hard, and the mass does not escape from ruptured points. During dissection the preparation should be covered with alcohol.

In case it becomes desirable to dissolve the injected mass from any part of the vessels, this can be accomplished by dropping dilute acetic acid upon it.

The preparation can be rendered transparent by first washing with water, and then soaking in glycerine. Treatment with alcohol again restores the opacity of the preparation.

METHOD OF KILLING GEPHYREA.—According to Apel[1] the only method of killing these animals, in an extended condition, is by the use of hot water. The animal may be placed in a vessel of sea water, and the temperature gradually raised to about 40° C; or it may be seized by a pair of forceps while in a condition of extension, and plunged for a moment into boiling water. This latter treatment does not kill the animal, but renders it completely limp, in which condition it should be cut open and then placed in some hardening fluid.

A MACERATING MIXTURE (central nervous system of vertebrates).—The following mixture, discovered by Landois, is recommended by Hans Gierke[2] as an excellent macerating agent, especially for the central nervous system of vertebrates:

Chromate of ammonium	5 g.
Phosphate of potassium	5 g.
Sulphate of sodium	5 g.
Distilled water	100 g.

Pieces of fresh-tissues are left in this fluid from one to three, or even four to five days, then transferred to a mixture (in equal parts) of this fluid with ordinary ammonia-carmine (24 hs.).

[1] Zeitschr. f. wiss. Zool., XLII, H. 3, p. 461, 1885.
[2] Arch. f. Mik. Anat., XXV, H. 4, p. 445, Oct., 1885.

HALLER'S MACERATING FLUID[1] (central nervous system of marine Rhipidoglossa).—

Glycerine	5 parts.
Glacial acetic acid	5 "
Distilled water	20 "

This fluid causes no shrinkage, and accomplishes its work in one-half to three-quarters of an hour.

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SCIENTIFIC NEWS.

PRINCETON, Feb. 16, 1886.

PROFESSOR E. D. COPE, EDITOR AMERICAN NATURALIST.

Dear Sir:—In the February number of the NATURALIST you say with regard to Professor Marsh's *Tinoceras stenops*, formerly referred by you to a new genus Tetheopsis: "I now learn on good authority that the symphyseal region in the specimen in question is entirely constructed of plaster of Paris." As I am the one from whom you derived this information, I feel bound, as a matter of simple justice, to correct the above statement, for having just reëxamined the specimen with great care, I find that I was in error in a very important respect. It is true that the left half of the symphyseal region (the only part visible when I first saw the specimen) is restored in plaster, but the right half is intact, and the restoration and drawing were made from that, a perfectly legitimate proceeding. So much I can positively state of my own knowledge, and I am also informed that the restoration was made after the time when you saw the specimen and after Professor Marsh's figure was published. Hoping that you will give this correction a conspicuous place, I remain,

Very respectfully yours, W. B. SCOTT.

[*Note on the above.*—I gladly give place to the above correction, but must append a little additional information. I saw the type specimen of *T. stenops* before 1885, probably in 1883. It was then half imbedded in a mass of what I supposed to be matrix, and the left side of the skull was exposed. The mandible of that side was at that time entire, as represented in Professor Marsh's plate. It exhibited a narrow entire alveolar edge without trace of alveoli or of weathering. What has become of this left half of the symphysis we are not informed. If it was the osseous jaw, the genus Tetheopsis is well founded.—*E. D. Cope.*]

— Among the scientific names included in the death-roll of the past year, is that of Thomas Bland, the author of numerous papers, principally on the "Land shells of the Antillean islands and the North American continent." Mr. Bland's labors and investigations included not only the descriptive and systematic, but also the geographical, structural and developmental

[1] Morph. Jahrbuch., XI, H. 3, p. 323, 1885.

aspects of Molluscan life, and his discussion of phenomena, in which these subjects were involved, is marked by judicious and philosophic treatment. He was the coadjutor of Mr. W. G. Binney in various ways, and their names appear side by side in several instances, particularly in the volume on the "Land and fresh water shells of North America," published by the Smithsonian Institution. In 1884, Mr. A. F. Gray compiled and printed a bibliography of Mr. Bland's papers and contributions to this department of natural history. Mr. Bland was born in Nottinghamshire, England, October 4, 1809, and died in Brooklyn, N. Y., August 20th, 1885. His father was a physician and his mother was related to Shepard, the naturalist. He received his education at the Charter House school, London, and had Thackeray for a classmate. Subsequently he studied and practiced law. In 1842, he went to Barbadoes and afterward to Jamaica, where he became acquainted with Professor C. B. Adams, which led to those investigations which gave to Mr. Bland honorable rank as a scientific thinker and worker. In 1862, he came to New York, and this country became his permanent home. He was a most estimable gentleman, courteous and genial, and greatly beloved by all who knew him.—*R. E. C. S.*

— The annual meeting of the Board of Regents of the Smithsonian Institution was held at Washington, Jan 13. The secretary announced that Congress had reëlected Doctors MacLean, Gray and Coppé as regents for six years, and General Meigs in place of General Sherman, resigned. Professor Baird submitted his report for the six months ending June 30, 1885. He also presented a financial statement showing that the receipts of the institution for 1885 amounted to $67,500, and the expenditures to $45,107, leaving a balance of $33,453. Professor Baird presented a statement showing the necessity for a storage building for alcoholic specimens, also for a new building for the museum, as there are enough valuable specimens to fill a second building the size of the present one.

—A telegram from Colima has been received by the Government, stating that on the morning of Friday, the 15th January, another eruption of the volcano occurred, preceded as before by loud detonations. Enormous stones were thrown to a great height, and were plainly visible from the city of Colima, which is twenty-five miles distant. Photographs depicting the volcano at the moment of its greatest activity were taken by the instantaneous process.

— Professor W. W. Bailey writes us that a few years ago there was an interesting discussion in the NATURALIST upon abnormal or unusual food of cats. "Now I have two kittens, both female, one of whom is especially fond of peanuts, cracking and eating them; and *both* of dates. Certainly this is diet unusual enough to be worthy of record."

— A monograph on the recent Brachiopóda by the late Thomas Davidson, LL.D., F.R.S., edited by Agnes Crane, will be issued in three parts, with thirty quarto plates, during 1886, and will form a separate volume of the Transactions of the Linnæan Society of London.

— The Academy of Natural Science in Philadelphia has, by the death of the widow of the late Mr. H. N. Johnson, come into possession of the entire estate as residuary legatee. It is valued at over $50,000, and the available annual income is nearly $1500.

— Dr. Daniel G. Brinton, of Philadelphia, has been announced as the Laureate of the Société Américaine de France for 1886, and awarded the medal of the society for his work on the native tongues of America.

— Dr. Walter Flight. chemist and mineralogist, and assistant in the mineralogical department of the British Museum, died Nov. 6, aged forty-four.

— J. J. de Tschudi, a Swiss naturalist and traveler, author of a work on Peru translated into English, died in January, at the age of sixty-eight.

— Professor John Morris, who held the chair of geology in University college, London, died in January, aged seventy-five.

— P. Harting, the distinguished professor of zoölogy in the University of Utrecht, died Dec. 7.

— *Erratum.*—On p. 171, line 27, for Orthopod *read* Arthropod.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Indiana Academy of Sciences.—In accordance with the call issued by the Brookville Society of Natural History, a number of Indiana scientists met at the court-house at Indianapolis, on Tuesday, Dec. 29, 1885, at 2 o'clock P.M. J. P. D. John, D.D., of DePauw University, was made temporary chairman and Amos W. Butler, temporary secretary. O. P. Jenkins, J. C. Branner and S. P. Stoddard, M.D., were appointed a committee on organization. They reported a constitution and by-laws which were adopted. The name selected is Indiana Academy of Science. The objects of the academy are "scientific research and the diffusion of knowledge concerning the various departments of science." The membership is to be confined to persons "engaged in scientific work or in original research." No provision has yet been made for fellowships. The committee on organization reported the following list of officers: president, David S. Jordan, Indiana university, Bloomington; vice-presidents, J. M. Coulter, Wabash college, Crawfordsville, J. P. D. John, DePauw university, Greencastle, Rev. D. R. Moore, Brookville; secretary, Amos W. Butler, Brookville; treasurer, O. P. Jenkins, State Normal School, Terre Haute; librarian, J. N. Hurty, Indianapolis, all of whom were elected. Papers were read giving, as far as possible, a statement of the present condition of knowledge in the various branches of science, as follows: meteorology, by W. H. Ragan; mammalogy, E. R. Quick; the work accomplished for natural and physical science, Richard Owen, M.D.; papers on C. S. Rafinesque and ichthyology, by D. S. Jordan, M.D.; botany, J. M. Coulter, Ph.D.; physics, Professor J. P. Naylor; lower invertebrates, Professor O. P. Jenkins; entomology, P. S. Baker, M.D.; herpetology, Professor O. P. Hay; mineralogy, Maurice Thompson; geology, R. T. Brown, M.D.; chemistry, Professor R. B. Warder; conchology, Rev. D. R. Moore; statistics, J. B. Conner; ornithology, A. W. Butler; geography, J. T. Scovell; astronomy, Daniel Kirkwood, LL.D.

A committee was appointed to incorporate the academy. The prospects for the future of the academy are very bright; the ablest investigators and best instructors of the State have united without exception to put this new institution on its feet. There will be two meetings each year, one between Christmas and New Year, the other early in the summer; the former will be held at Indianapolis, the latter will be held at different places throughout the State. The next meeting will be held at Brookville, beginning May 20, 1886.

The American Committee of the International Congress of Geologists.—This committee met in the Windsor hotel, New York city, on Friday, January 8th, with the president, Professor James Hall, in the chair. There were present Dr. T. Sterry Hunt, Professor J. S. Newberry, Professor C. H. Hitchcock, Professor J. J. Stevenson, Professor Geo. H. Cook, Mr. McGee (representing Major Powell), and Dr. Frazer, the secretary of the Berlin delegates, who was elected the secretary of the meeting, and read his report of the proceedings of the Berlin congress. His action in ordering 300 extras to be struck off by the printer of the journal, and also 300 copies of the color scale to be printed in Berlin to accompany the report, was approved.

It was decided that translations of the reports of the committee on the map of Europe and on the uniformity of nomenclature, together with an abstract of the English committee's report, should with the American committee's report, and under the direction of Dr. Frazer, be distributed among American geologists under conditions which seemed best.

A committee of five was to be appointed to take measures in advance of the London congress to have American views properly represented; to be prepared for discussion of certain subjects, and to ask the congress to meet in America at its next (after the London) session.

After some other minor matters were decided, Professor Hitchcock was selected to apply the international scheme of coloration to an area which has been selected by Major Powell to test various systems on.

The meeting adjourned to meet at the call of the president.

New York Academy of Sciences, Jan. 18.—The following paper was read: The San Juan mountains of Colorado, by Dr. R. P. Stevens.

Jan. 25.—The Cretaceous flora of North America (with lantern illustrations), by Dr. John S. Newberry.

Boston Society of Natural History, Jan. 20.—Professor William M. Davis spoke about the "Chinook wind" of the Northwest; and Mr. S. H. Scudder discussed the relationships of the Mesozoic cockroaches.

Feb 3.—The bow and arrow unknown to Paleolithic man, by Professor H. W. Haynes; On the Santhals, an existing aboriginal tribe of Northeastern Bengal, by Dr. S. Kneeland. Photographs of the people and specimens of their singular native ornaments were shown.

Appalachian Mountain Club, Jan. 13.—The officers for the ensuing year were elected, and the reports of the corresponding secretary and treasurer presented. The following papers were read: The ascent of Popocatepetl, by Professor A. S. Packard; The Carter-Moriah path and camp, by Mr. William G. Nowell; Notes on the region east of Wild river, and south of the Androscoggin, by Mr. A. L. Goodrich.

The Cincinnati Society of Natural History presents a programme of the fifth course of free popular science lectures, as follows: Friday, Jan. 8, 1886, Hudson's bay and its territories, Mr. Wm. Hubbell Fisher; Friday, Jan. 15, Ants and their habits, Professor A. D. Morrill; Friday, Jan. 22, Science in schools, Rev. Geo. M. Maxwell; Friday, Jan. 29, Clarification of water, Professor C. R. Stuntz; Friday, Feb. 5, Gas wells of Ohio, Professor Edward Orton; Friday, Feb. 12, Glacial theories, Professor J. W. Hall, Jr.; Friday, Feb. 19, Our world a type of other planets, Professor Geo. W. Harper; Friday, Feb. 26, Astronomical review, Professor R. W. McFarland; Friday, March 5, An Australian fern-tree forest, Rev. Raphael Benjamin; Friday, March 12, Nebulæ and star clusters, Mr. Wm. H. Knight; Friday, March 19, Experiments in electricity and magnetism, Mr. Geo. F. Card.

Crawfordsville Scientific Society.—This society is established in connection with Wabash college, but includes citizens of Crawfordsville interested in scientific subjects. At the December meeting Professor John M. Coulter spoke of some puzzling forms of parasitic fungi recently found growing in a solution of sodium acetate; Professor Dunn brought out a number of valuable points which had come under his observation in studying the habits of the salamander; E. H. Marshall gave the results of a chemical analysis of a valuable clay recently discovered in this county; H. Thomson traced the development of the cerebellum from the lowest vertebrates to the highest; J. N. Rose gave the details of an experiment for showing the transpiration of plants.

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The American Naturalist.

DEVOTED TO THE NATURAL SCIENCES IN THEIR WIDEST SENSE.

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THE

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THE ANCESTRY OF NASUA.[1]

BY SAMUEL LOCKWOOD, PH.D.

AFTER a chronicle of such achievements of Coati-Mondi and her Cousin "Coon," shall we not institute a serious search into the origin of the heroine, and so establish or set aside our suspicion? "So I should think," says an interested reader, "after such a tidbit of revelry in the romance of science-dom or dreamland." So, ho! a challenge to the array! Then let the contest come! But pray, good sir, is there not in this realm of science an imagination which conducts to light and truth, as against that romance which leads surely to error and darkness? But what is scientific romancing? Is it not that unscientific conduct which, as if contributing to knowledge, asserts the untenable and untruthful? Sometimes the conceit is so unwarranted as to appear on its very face a vagary, extravagant and impossible.

Science thinking is reverend and reserved—for here dash is impudence, nor is cheek courage. The habitual theorist finds a fascination in sheer novelty—of such the cautious thinker is chary. But if the giddy and reckless are proscribed the use of edge tools, the sober-minded is allowed the tentative hypothesis. The one would cut the knot, the other would untie it. The honest theorist is simply feeling his way. He may have *a priori* methods despite of Mr. Gradgrind's much mouthing for "facts!" Such modest ventures, "assumptions," may prove real forecasts of wide significance. But such is not romancing. Nature has her seers, who have happily uttered esoteric truth which has afterwards crystallized into accepted theory in the formulation

[1] From a forthcoming work by Dr. Lockwood.

given it by the setting of the factors denominated "facts." So it was with Germany's great poet. But here comes a nice distinction between the condemnable and the commendable, between romancing in science and the scientific imagination. Goethe's guesses were neither blunders nor vagaries. His theory of the genesis of the flower, of the vertebrate origin of the skull, and his forecast of the doctrine of descent, were all marvelous births, but legitimately begotten, the offspring of pure scientific imagination. As in advance of the thought then in vogue, they seemed prematurely brought into the light, and for a time were nurslings of unpromising vitality.

But a truth thus evolved finds no similitude in the spark struck out by flint and steel. Nor is such truth premature, as to its ratiocination, as would appear could we but time its gestation. I think it is always the outcome of "unconscious cerebration." The mind of the seer has been deeply thinking on generic lines. As first expressed such a truth may be ore-like—rich, but crude—and it may have to wait for the facts which shall serve as faggots for the crucible.

Having in the article "Coati-Mondi and its Cousins," with perhaps seeming insufficient warrant, asserted for Nasua a quadrumanous kinship, now that the faggots have been got in plenty, why not smelt the ore? Or, dropping metaphors, let us go in direct quest of Nasua's ancestry, even its biogenesis, upon reasoning lines.

In tracing the pedigree of some regal line, perhaps we should reach a very ancient Norman stirp. But however ancient, it would be the Norman of civilization, not his savage progenitor of the Palæolithic age. This would be as far up the stream of the past as we could sail. So with our Nasua, we must stop at the origin of the Educabilia, the quasi intelligent animals, those namely which have the cerebrum or frontal brain relatively large and roofing, or overlapping the cerebellum or small hinder brain.

1. First then, as to that quadrumanous alliance of Coati; on what line of reasoning may the genealogy be traced? My first impression of this fact came to me as a conviction of the imagination. I did not then, it is so long ago, know anything of the modern doctrine of "unconscious cerebration." I had so studied the living animal as to fairly know its ways, and I came to suspect, as an inheritance, the monkey strain, as the breeders would

say. I could see the traits but could not demonstrate them. At best I could but quote the great poet:

> "Such seething brains,
> Such shaping fantasies, that apprehend
> More than cool reason ever comprehends."

2. That which backed up the imagination was the psychological or mental manifestation. Here were data for comparison, in such well-marked lines ran the parallels of expression of the Nasuan and the monkey mind. The hints afforded in the complex use made of the hands and the tail—the many unmistakable monkey didos, or antics, which came not of training nor of aping, but of real generic aptitudes. These all pointed to a physical correspondence, and looked directly to ancestral inheritance.

3. I think it was in 1873, the year after the appearance of my article, that an interesting anatomical discovery was announced by the great academician, the successor of Cuvier, Henri Milne-Edwards. He had dissected a Nasua and had discovered in the limb bones of this animal structural alliances to the lemurs, or lowest monkeys. Here was, indeed, a pleasant and important confirmatory fact.

4. But to round up the proof, one more class of evidence is needed, the testimony of palæontology. In behalf of the extinct animals will the fossils bear witness in this matter? The writer was instructor in the natural sciences in the grammar school or preparatory department of Rutgers College, when he received from its author a pamphlet "On the principal types of the orders of Mammalia Educabilia," by Professor E. D. Cope; read before the American Philosophical Society, April 18, 1873. My eyes caught a foot-note to one of the pages, thus: "Dr. Lockwood, of Rutgers College, in a recent number of the *Popular Science Monthly*, expressed serious suspicions of the quadrumanous relationships of the Coati, little thinking at the time that the specimens to confirm his view were at that moment in the hands of palæontologists."

Let us now take down this testimony from nature's own mouth. Certain fossil bones had been found in the Eocene formation of Wyoming. Previous to the Eocene period of time the fauna of this world's life-history had consisted of animals of a very low grade on the mammalian lines. Technically they are classed as the Ineducabilia. In the Eocene days the creative force was exercised on higher lines of life. Then were produced the real ancestors of those animals which are included in the zoölogical term Educabilia, whose cerebral physiology has been already explained. As notable genera of those days I may mention the pseudo-bear—Notharctus of Leidy, and the cut-tooth beast—Tomitherium of Cope. Others there were by Marsh, but their descriptions are not in my reach. Leidy's species, *Notharctus tenebrosus*, described from very limited material, was a little animal about two-thirds the size of a raccoon. Cope's species, *Tomitherium rostratum*, founded on a much larger amount of material, was an animal probably about the size of *Cebus capucinus*, the prehensile-tailed monkey so common in shows. Upon technical considerations both these animals, albeit their strange and high-sounding scientific names, were low-grade monkeys. They were quadrumanous animals but of a synthetic, that is, comprehensive type. The femur of Tomitherium was so long as to indicate that the knee was entirely free from the body, as it is in the whole monkey tribe of to-day, but never in any of the carnivores. The round head of the radius indicates a complete power of supination of the fore feet; that is, the ability to lift the hand, so to speak, forward and to turn the palm upward, a faculty of limb peculiar to monkeys and man, while the distal or lower end of the same bone resembles closely that of Semnopithecus, a high-grade old-world monkey. "We have then," continues Cope, whom we are epitomizing, "an animal with a long thigh free from the body, a foot capable of complete pronation and supination, and a form of lower jaw and teeth quite similar to that of the lower monkeys."

And in this connection what about our Coati? Says the professor: "A comparison with Nasua reveals no distant affinity. The fore limb presented in Tomitherium a great similarity to that of Nasua." And in both genera are some striking similarities in the cutting teeth. "The first impression derived from the appearance of the lower jaw, and the dentition, and from the humerus, is that Tomitherium is an ally of Coati, the humerus being almost a *facsimile*." And is it not a striking coincidence that Professor Leidy's first impression of Notharctus was of a resemblance to Procyon, the raccoon, which, as we have shown, is generic with Nasua.

It is evident then that Tomitherium and Nasua show some alliances in structure which look to a common origin or biogenesis, but it is a descent on different lines. From his study of an immense amount of fossil relics from the same geological formation which yielded Tomitherium, Professor Cope has erected the order Taxeopoda, which includes these fossil lemurine forms. This order occupies the earliest section of the line of the Primates. First in these fossil forms come the Lemuroids at the base of the Primate lineage. After these extinct forms appear the true Lemuroidea, that is, the present or living Lemurs, followed by the monkey proper, and these by the anthropoid apes. Now, among the lemurine forms, and fairly started on the quadrumanal line of descent from the typical lemurine order Taxeopoda, occurs Phenacodus, after which Tomitherium appears somewhat farther advanced on this Primate line.

Now, on an off-line or branch from the lemurine Taxeopoda, starts the flesh-eating line; first the Creodonta, the "slaughter-teeth," then the Carnivora proper, with the present living forms. Cercoleptes connects Nasua to the extinct Creodonta, and through these back to the lemurine order Taxeopoda, their ancestral stock.

So we have at last found the Nasuan lineage and ancestry in the Eocene times. Phenacodus was an animal of a synthetic structure, a comprehensive type, from which flowed several ordinal streams of life. In such a composite form, or structural make-up, can we not surmise the creative possibilities and purposes of the Divine Mind?

It is an interesting fact that in a direct line one of Nasua's ancestors still exists in the same forests of South America. The kinkajou, *Cercoleptes caudivolvulus*, reduced to one species. When tamed it is an interesting little animal with amiable ways and monkey traits. The tail is prehensile in that it curls around an object, which with plantigrade feet give it in Germany the name curling-bear. Like the monkeys it will hold its food in one hand and break it and feed it to the mouth with the other. So then, kinkajou and Coati-Mondi come honestly by their monkey tricks, having a clear title by heritage.

Without turning homilist let me close by citing Ruskin and one of the great ancients: "The greatest thing a human soul ever does in this world is to see something." The Hebrew bard both sang and prayed: "Open thou mine eyes, that I may behold glorious things out of thy law!" And this biogenesis of Coati-Mondi, is it not one of the wonderful things—an outcome of Divine law?

THE MECHANICS OF SOARING.

BY I. LANCASTER.

IT was foreseen that the paper on the soaring birds in the November and December numbers of the NATURALIST of last year would provoke adverse criticism where it dealt with explanations of the movements of those creatures. The recognized laws of the mechanical forces being formulated from data derived from systems of which the earth is a part, makes it extremely difficult to deal with phenomena which are independent of that body, while still existing in its atmosphere.

There arises at every step taken to elucidate the matter, a seeming conflict with accepted laws, and however faultless the reasoning, it is discredited because of that apparent antagonism.

The word "soaring" is also a bad one to name the mechanical actions involved, as it implies a bird. No better, however, is at hand, and it denotes the method employed by the bird and not necessarily the creature itself, as it is here used.

While prosecuting the subject experiments of various kinds were conducted to dispel the obscurity which enveloped it, as careful observations had shown that it was completely different from any other kind of bird flight. Of almost half a hundred theories framed on postulates of bird or air, which were not true, *one* at length was found to be consistent with the facts. I suddenly found myself in the ludicrous predicament of industriously attempting to prove an axiom. My experiments became valueless. Time and means had been wasted. There already existed recognized data to make the whole case self-evident.

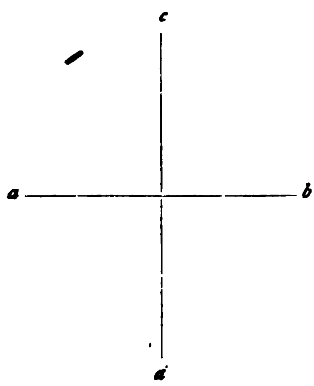
It is now more than five years since the discovery of the mechanical activities herewith detailed. During that time the matter has been made a study in all its bearings, so that mistaken conceptions might be avoided, and it is herewith presented to the mechanical world as worthy of serious attention.

Technically, the material system of soaring is a flat surface, air, and a force. The gravitating force is not essential to it. Any force, a push with the hand, horse-power, steam-power or any other will fill the conditions. Neither is *atmospheric* air essential. The *air* must have the quality of great elasticity and offer considerable resistance to a moving body which compresses or drives it out of the way, and very little to the passage of a smooth, flat surface like a sheet of tin, edgeways in it. The force is then applied to the body in such a way as to move it at right angles to the direction in which the force acts. This translation of the body is "soaring." It rests on two universally recognized laws. The most important is the conservation of energy, of which it is the most beautiful illustration to be found in mechanics. The other is the reaction in all directions of fluids under the action of mechanical forces.

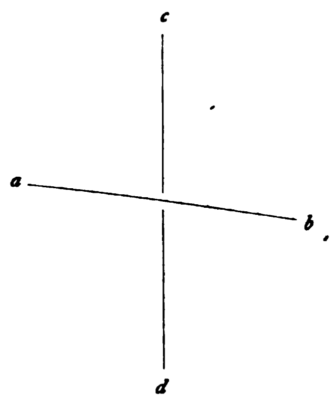
The body must be so constructed as to have at least two directions of motion which are unequally resisted by the air.

The case will be first presented as operating in space devoid of gravitation, where the body will have no weight, and afterwards the system will be introduced into the earth's atmosphere. Implications arising from the action of gravity, and the constant tendency to introduce the earth into the soaring system, will be avoided.

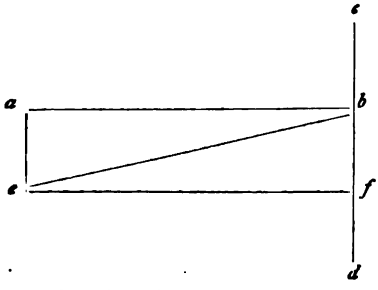
Suppose the body to be an oblong flat surface, such as a sheet of tin 12 × 72 inches, and that *a b* is its transverse section, and that the force moves from *c* towards *d*, at right angles to the sides of the surface.



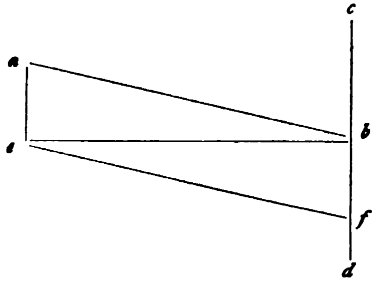
Surface at right angles to the direction of the force.



Surface inclined to the direction of the force.



Lateral motion of surface at right angles to the force.



Lateral motion of surface inclined to the force.

That the value of the force is twelve pounds moving the surface on the air with uniform velocity, which we will suppose to be five feet per second. Under these conditions it is obvious that all the force is employed in condensing and otherwise disturbing air, so that it is doing work on the air at the rate of twelve pounds each second. It is also obvious that while uniform velocity occurs there is a moving equilibrium between the surface acted on by the force and the reacting air, and that any additional force, however small, applied to the surface at any angle to its own plane would disturb this balance, and either accelerate or retard its velocity. If, however, the additional force be applied in its plane, lateral motion would occur without changing the equilibrium. In the lateral motion no air is disturbed, nor driven out of the way, nor condensed, excepting what is caused by smooth skin, or surface friction, and this is so very small as to elude all my attempts to find its value. One pound applied in the plane of the surface would doubtless drive it at the rate of 1000 feet per second. We will suppose, however, that one pound will drive it from *b* towards *a* at the rate of thirty feet per second. As it is moving towards *d* at the rate of five feet per second, it will pass neither towards *d* nor *a*, but on the diagonal *b e*, the resulting path, the parallelogram being thirty feet long and five feet wide.

Note the character of the equilibrium between the surface and air. The total force is flowing around the edges of the surface in the shape of condensed and otherwise disturbed air. If the hand were placed under the surface with an upward push, precisely as much resistance as would be *given to* the hand would be *taken from* the air, and the velocity retarded. If scales were applied to the surface and a pull towards *c* given, part of the force would be moving the index and precisely that much less would be working on air, and the velocity of the surface would be again retarded. If the surface met with sufficient impediment to stop its motion, *all* the force would be resisting the impediment and *none* doing work on air, and velocity would cease.

It is evident that at uniform velocity the force has been transferred. It is in the air tension, and not in the surface, for to be also there, would necessitate its creation out of nothing. There being then, no force in the surface, it could not antagonize any resistance offered to it, and this is in fact its condition as we have seen. While its velocity remained uniform it would obey any impulse derived from incident forces directed upon it, being powerless to resist them.

So far all is evident, but the surface would not fill the conditions of soaring. Its motion is not at right angles to the force, but inclined thereto, and to accomplish the desired result its path must be perpendicular to the force.

If we now tilt the surface on one of its long edges, *b*, say for two inches, or one in six, it would no longer follow the direction of the force, but slant sideways towards this edge. Following the law of the composition of forces, one-sixth of the force, or two pounds, will now drive the surface sideways, and there being nothing but trifling skin friction to oppose it, it will obey the impulse. But if we apply a force of two pounds to the edge to balance this thrust, equilibrium will once more occur and the surface will move in the path of the force. Experimentally, far less than two pounds is required for this rest, as a considerable incline is reached before the sideways thrust is developed, the confused air currents under the surface obscuring the movement.

Note that this abutting force is of the nature of pressure. It is a static feature devoid of motion. It is a rest for the tilted surface to lean against.

It cannot be denied that we now have a case of equilibrium once more. With the two-pound rest a perfect balance results and the surface moves in the path of the force. All the force is disturbing air, while the surface moves with uniform velocity. *At that speed* it is unable to offer the least resistance to any further force which may be opposed to it. At this point the answer to a single question will be decisive. If it be in the affirmative the position is secure; if in the negative, my explanation of soaring is wrong, the birds are still in the air waiting solution.

The question is this: Will the tilted surface, supplied with the rest of two pounds and moving with uniform velocity, obey the impulse of an external force, applied in its own plane, with equal facility in any direction?

It certainly is evident that the only resistance to such a force arises from skin friction in whatever way the motion is made. If there be any other from whence comes it? It cannot come from the original force, for this is fully employed. It cannot come from the two-pound rest, as this is already balanced by the sideways thrust of the reacting air. This does not vary with the velocity in the plane of the surface. It is two pounds at all velocities; motion in the plane of the surface does not change the *value* of the condensations, but only their *character*. It makes them thinner but wider, the total of twelve pounds being constant at all velocities; so that the two-pound abutment can only vary with the inclination of the surface to the direction of the force. It is obvious that a force applied to the surface in the direction of its length, will move it either way indifferently. It can be seen at once that the two-pound rest will not resist such a force at any velocity whatever in these directions. Leaving unnoticed any oblique motion neither longitudinal nor transverse, the important point is, will a given force, say of one pound, move the surface towards *a*, with the same velocity as towards *b*?

It is possible that when the lateral motion is set up there might be developed in the air disturbances, differences which would require an increase or diminution of velocity towards *d*, to balance the twelve pounds, and that these differences would be greater or less towards *b* than *a*. But this would in no way affect the lateral motion. Acceleration or retardation would go on until equilibrium again occurred, so that it would be a balanced surface which is moved. The vital point is: Does or can the twelve pounds in any way resist the lateral motion either towards *a* or *b*? It seems evident that there is no conceivable way in which the lateral motion in either of these directions can be resisted by the twelve-pound force, under these conditions, without at once traversing the law of the conservation of energy. The only resistance to be found is the skin friction on six square feet of smooth surface under a pressure of two pounds to the foot.

If this be a fact the case is proven. There is no other feature of it which would be denied.

Note the implications of the case. The lateral motion caused by the one pound would now carry the surface to *b*, while it is going to *d*, and it would pass to *c*, at right angles to the twelve-pound force. In going thirty feet laterally it moves sixty inches *contrary* to the direction of the force of twelve pounds and sixty inches *with* that direction, so that its path is at right angles to it. The motion of sixty inches *contrary* to the force is a function of the lateral motion and does not resist the force in the remotest manner; while motion of sixty inches *with* the force, towards *d*, is the direct result of this force. While the lateral motion is going on at the rate of thirty feet per second, twelve pounds per second of air disturbance is flowing past the edge *b*, while but three pounds is required to give the lateral thrust and furnish the two-pound rest. If this edge be rounded upwards along its seventy-two inches of length to serve as a base for the expanding air to act against, it will give the needed three pounds and still leave nine pounds to go to waste by falling to the tension of the surrounding air. With this substitution the soaring action is complete. The force is now translating the body at right angles to its own direction. It will be noted that a velocity towards *a* greater than thirty feet per second will cause the surface to move *contrary* to the direction of the force faster than *with* it. Also, if a greater inclination be supposed, the abutting force would be greater, and the above contrary motion augmented. A limit would soon be reached in this direction, however. At an incline of one to four the rest would be three pounds, at one to three, four pounds, which latter would pass the limit of soaring, as it would require a rear expansion of five pounds to effect lateral motion, a utilization of five-twelfths of the entire force, which would surpass the ability of the system.

A single further peculiarity is to be noted. Suppose the indefinite body of air belonging to this system to be in motion, either *with*, or *against*, or at any angle whatever to the direction of the force. The action of the parts of the system would remain unaffected by such motion. It is universally recognized that the translation of a system as a whole has no effect on the interaction of its parts.

Let us now suppose the motion of the body of air containing the system be towards the earth's atmosphere in a direction tangential to its surface, at the rate of one hundred miles per hour, until the air of the system and the atmosphere became identical, we would have a bird soaring in wind of that velocity, and this wind, or any other wind, or a dead calm, or wind vertically downwards, or upwards, or at any other angle, are identical states of air so far as the soaring system is concerned.

In the earth's atmosphere, surface and air will remain the same, while the force will be that of gravity. The surface *now* has weight. It is a body plus a force, and the entire matter is the same that we have been considering. The surface is a soaring bird. It is an inert body translated at right angles to the gravitating force, or horizontally, and solely by the action of that force. It has constant motion in the direction of gravity but does not lose its energy of position by getting nearer the earth. It resembles *in this respect* a clock moved by a weight, and placed on the platform of an elevator which slowly ascends. While the clock weight is a falling body having motion in the direction of gravity, it still does not lose its energy of position by getting nearer the earth, because of another motion in which it is elevated.

The surface, under the action of this force as above conditioned, is a splendid atmospheric highway maker. It lays down an endless cushion of air on which it travels with incredible speed. It is paralleled by nothing in nature. It is gravity in the rôle of a continuous motive power. It obeys implicitly the laws of mechanics in every particular, and gives man complete dominion of the air.

When the attention is directed to soaring in the earth's atmosphere, as exhibited by the birds, two delusions must be industriously guarded against. One is that wind is concerned in the phenomenon. The other is that the horizontal motion of flight is the result of a single impulse acting in one direction.

When it is seen that motion is derived from gravitating force exhibited by the quiescent bird in all cases, and that its level flight is a compound result of two motions, one vertically downwards, and one slanting upwards in the plane of the wing surfaces, both simultaneously occurring, the subject assumes a more explicable form.

Then when it is seen that no weight is lifted in the upward slant, this action bearing no resemblance to a ball rolled up an inclined plane, the case will be in a fair way to be completely comprehended.

In conclusion, I may be pardoned for indicating the direction in which criticism of this paper may be fruitful.

It is easy to lose oneself in the limbo of a vicious terminology. To show that expressions in regard to the gravitating force being "a continuous motive power," and conferring on it other unusual abilities not hitherto recognized, are unwarranted, is not to weaken the case. It will merely show an improper use of words.

Statements of fact regarding the plane inclined to the force, and culminating in the possibility of equal ease of motion in any direction under the conditions given, contain the vital elements.

As an explanation of soaring birds the facts of the transformation of gravity into air disturbance, and the results flowing therefrom as stated, are pertinent. To invalidate that explanation it must be shown:

1. That such transformation does not take place.
2. That no such results as those given are possible.

——:o:——

THE STONE AX IN VERMONT.[1]

BY PROFESSOR GEO. H. PERKINS.

II.—NOTCHED AND GROOVED AXES.

IN all our collections we find a few axes which are notched or grooved across the narrow sides. They are not common in any portion of Vermont, nor, if we may judge from what has been published by various writers, do they appear to be abundant anywhere in the United States.

As was noticed in the preceding article we are able to arrange our specimens in such a manner that there is a very complete series from the simplest celt, through the notched ax, to the fully grooved ax, and it seems quite probable that the notched ax was the second step in the development of the ax from the simply edged pebble. The form of the notched ax is more like that of the common celt than is that of the grooved ax. In fact some of the notched axes are nothing else than celts notched at the sides, and they are never so large and heavy as are many of the grooved axes.

FIG. 1.

A type of these axes is shown in Fig. 1, which represents a common form, about one-half the natural size.

As a rule these axes are not more than four or five inches long and two or three wide. They are usually well shaped, neither rude nor clumsy, and the surface is smooth or perhaps polished. The form of some is such as to suggest the adze, and it seems quite likely that an implement so useful in hollowing canoes and

[1] Continued from p. 1149, December number, 1885.

performing many of the labors which we know to have been undertaken, was in common use among the prehistoric tribes as it has been for a long time among modern savages, and yet I do not remember that the early writers to whom we always turn for information respecting the customs of our predecessors, say very much of the use of such a tool in their accounts of these people. It is not impossible that some of the implements which we call celts may have done duty as spades, and that some of the ruder "notched axes" may have been, not axes, but hoes. The notches or grooves are always much wider than deep, although the depth varies very greatly in different specimens, but I have never seen it as great as in the grooves of some of the larger grooved axes. The notches are usually about a third of the length below the blunt end of the ax, though in a few cases they are near the middle, as in Fig. 2. These axes group themselves naturally into two classes—those in which the width greatly exceeds the thickness and in which the surfaces are nearly or quite flat, and those in which the breadth and thickness are more nearly equal and in which the surfaces are often convex. Some specimens have one surface quite flat and the opposite convex, just as is often the case in the celts, and it is possible that these were used as skin-dressers or fleshers, and without a handle, the notches serving as convenient places for the fingers as the hand grasped the tool. The specimen shown in Fig. 1 is of dark porphyry and is polished over the whole surface, and is, as indeed are most of these implements, made with care and skill. It is four and a quarter inches long and two inches in greatest width. In Fig. 2 we have quite another form of ax, and one which is not common. It is about four inches long and two and a half inches wide. It is made of trap, and it is noticeable that most of these small axes are made of hard, compact material. I have seen no specimen of the notched ax which, like some of the celts, was sharpened at both ends, but one or two of the latter are drawn in near the middle as if the maker had thought of notching them that a handle might be more firmly attached, and these are almost notched axes, although the notch is so very slight that I have not thought best to include these specimens in the present article.

FIG. 2.

With very few exceptions the grooved axes found in Vermont are larger than those we have called notched axes. They are not at all abundant in any part of the State, and in the northern counties they are very rare. It is quite remarkable that in some localities where celts and other implements are especially common, grooved axes have been very seldom found, if at all. As compared with the Southern or Western grooved axes, our Vermont specimens present differences which are sufficiently noticeable when one looks over series of each, but which can not readily be made apparent in words. Our axes are, in size, intermediate, none of them being so small as the little "toy" axes found in other localities, nor are any so large as many that have been found. Neither do we find axes grooved only on three sides, but in all our specimens the groove extends entirely around the ax. In the collection of the University of Vermont there is one specimen, which is doubtfully of Vermont origin, in which the groove is found only on three sides, but in all the rest the groove is completed around the specimen. This is somewhat remarkable, because, according to Dr. Abbott (Primitive Industry, p. 8): "Possibly two-thirds of the stone axes found in New Jersey have the groove extending along the sides and across one margin;" and the same author speaks of "one-half probably of the axes found in Connecticut and northward having the groove entirely encircling the stone," and by inference the other half were not so. Our axes usually have the groove a little above the middle and parallel with the edge. It is never very near the blunt end, as in some of the Western specimens, nor is it ever bordered by a raised lip. Our average specimens are from five to seven inches long and about two-thirds as wide, and weigh two or three pounds, but occasionally they are larger, as is the specimen shown in Fig. 5, which is one of the largest axes I have seen from this region. Some of our grooved axes were evidently made from cobble stones, and in some of these the upper end is left very much in its original condition with its water-worn surface unwrought. The same form seems to have been copied in specimens the entire surface of which is wrought, for although these may show everywhere tool-marks, the form of the head is precisely that of those in which it is the natural water-worn pebble. In general form the Vermont axes are noticeably wider, shorter and thinner than the typical Western specimens, and therefore less clumsy and heavy, even when of the same length. The long, slender axes found in some of the Western localities do not occur in the Champlain valley.

Our grooved axes are not often very rude but, though seldom polished, the surface is generally well picked and smoothed. The edge is, naturally, always polished, but the groove is not in any specimen so completely smoothed that the pits and striæ made by the instruments used in excavating it are obliterated, and in most cases there is little attempt at polishing it. Even when the rest of the surface is smoothed, the groove is not. This is unlike what is common among stone axes from other places, for in these we very often find the groove finely polished.

In Fig. 3 we have represented a specimen of singular form, and in some respects unique.

As the figure shows, the notches are very deep, though the groove is quite shallow, and the form of the head above the groove is unusual. The material of which this ax is made, instead of being of trap or quartzite, or some such hard, compact stone, is quite peculiar in that it is of a red sandrock common along Lake Champlain, and which is not a very suitable material for an ax. As shown in the figure this specimen appears more rude and ill-finished than it was originally, for, either from the effects of weathering or hard usage, the smooth surface which evidently existed at first, has been flaked off in many places, giving a rude appearance.

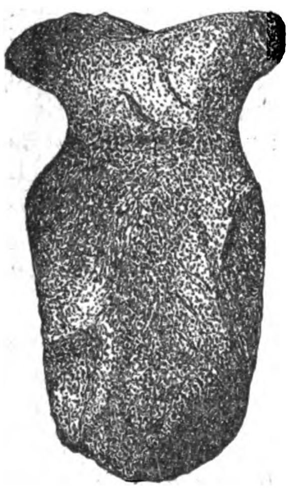


FIG. 3.

This is one of the larger of our axes, the length being eight inches, width across the head four and a half inches, while the general width below the groove is four inches. The special peculiarity of this ax is found in the obliquity of the edge, which is not very well shown in the figure. That portion of the ax below the groove is not worked to the same plane as that above, but is as if twisted spirally so that a line drawn parallel to the edge would cross at a large angle a similar line drawn across the head or parallel with the groove. Nor is this an isolated example. In a fine large ax in our collection, from Springfield, Mass., the same obliquity in the lower part is seen, and in several celts I have seen the same form. So marked is this twist that it would seem impossible to strike a fair blow with such an ax if it was attached to a long handle, and this difficulty raises the question whether some of these large grooved axes may not have been hand axes, not many of them, perhaps, but a few. The head of the Springfield ax is rounded carefully, and indeed the whole ax is very well made, and when held in the hand with the ends of the fingers in the groove, it seems most admirably adapted for use in this way. I am aware that the groove in itself suggests a handle of some

FIG. 4.

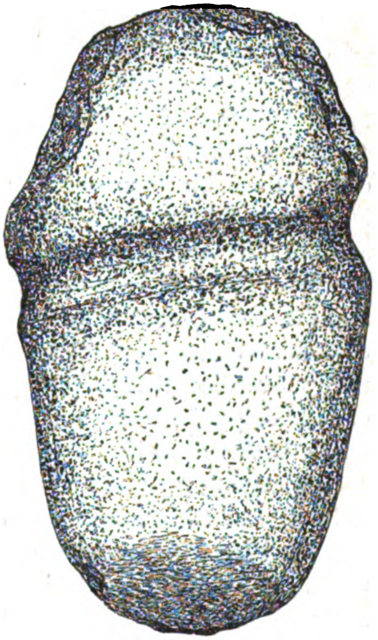


FIG. 5.

sort, but, as has been noticed, in the case of these oblique axes at least, the hand and arm of the user would surely make a much better handle than any other. The form cannot be regarded as accidental, I think; the specimens are too carefully and thoroughly made to allow place for such a supposition.

The general character of our Vermont grooved axes is very well shown by Figs. 4 and 5, which represent the two classes most often found. Both of them are comparatively quite flat or thin, and our grooved axes never approach a cylindrical form, but are always narrowly elliptical in cross-section. Scarcely any two specimens are alike, but most of them resemble more or less closely one or the other of the forms here figured. The specimen shown (very much reduced in size) in Fig. 4 is a very well made and finished ax, worked out of a syenite cobble-stone, and the upper end apparently still retains the general form of the pebble. It is of average size, being five inches long and three and a half inches wide just below the groove. This specimen illustrates the short and wide form, while the less common and longer form is seen in Fig. 5. This ax is one of the largest specimens, and most, if not all, of this form are large. Some of them are less rude than that figured, which shows the effects of hard usage, though it probably was very well finished at first. It is made of a dark gray grit or hard sandrock, much like that used for making the harder varieties of grindstones. The flat surfaces are rubbed quite smooth, although somewhat pitted. The groove is only moderately deep, but is unusually wide, and is smooth as if worn by long usage, and as the figure shows, it runs obliquely. Both sides are flat, one somewhat more so than the other, and the edge is formed by beveling the surface, mainly from one side. This ax, and the same is true of all of this form, was evidently worked out of a mass taken from a ledge. Not only does the smoothness of the groove show that this implement has been much used, but the edge is chipped and broken somewhat, and the head very considerably battered as if it had done hard duty as a maul. It has been thought by some that these large axes were, some of them at least, used to break holes in the ice in winter for fishing or to get water, and this specimen may have served for some such work. Very few axes so large as this have been found in this State. The figure is somewhat more than one-third natural size. The length is a little over nine inches, and the width above the groove nearly five and a half inches, while just below the groove it is five inches. The specimen weighs four pounds, which is much less than that of some of the Southern specimens. The inequality of the two flat sides, which is sufficient to be quite noticeable in this specimen, is still more marked in some others, and, as in the celts and other forms of the ax, this flattest side is always smoother, sometimes very much so, than the opposite side, a fact for which it does not seem easy to account. In a skin-dresser or hand ax it is quite natural that the side which, from accident or intention, was most nearly flat should be held down upon the skin or whatever the surface that was being worked, and thus become smooth and flat even if not made so at first, but how anything of this sort could take place in a large, hafted ax we are unable to guess, unless it was used as an adze, and this is possible. The oblique direction of the groove seen in this specimen is worthy of notice, since it does not appear to be common in New England specimens. Dr. Abbott (Primitive Industry, p. 8) says that in the valley of the Susquehanna river in Pennsylvania the majority of grooved axes have the groove oblique with reference to the edge, but that this feature is rarely met with in New Jersey and "probably does not occur in New England. There is no example in the large series of New England axes in the museum at Cambridge." Several of our Vermont axes, all I believe from the northern part of the State, have oblique grooves.

I do not think that archæologists have given the grooved ax sufficient credit for utility as a cutting implement. They seem for the most part to be of the opinion that at best these axes could be used only to cut into the bark and bruise the wood so that a fire kindled about a tree so prepared should have greater effect. This may very probably have been a common, perhaps the common, method, and yet the accounts given us by the early explorers of America seem to me to prove that trees were cut, and cut so that they came down, with stone axes. We must always be on our guard against rendering judgment as to the usefulness of a stone implement if we have no other basis for our decision than the results accomplished by it in our unskilled hands. We all know that stone implements that would be wholly useless in civilized hands are yet of very great efficiency in the hands of savages who have learned how to use them. Many of our stone axes do indeed seem quite unfitted for use as cutting tools, and they may be so, but all are not; some are made from very hard stone and have a smooth, regular edge which, although it may not be comparable to that of a modern steel ax, is yet able to cut soft green wood if not that which is harder. To cite in proof of this only a single writer, let me call attention to one or two statements made by Champlain. The earliest edition of the writings of this explorer, which is now at hand, was published in Paris, 1830, a reprint of course of earlier volumes, but sufficient for our purpose. In his account of a journey which he took with a party of Algonkins in 1609, Champlain speaks several times of the stone axes as used to fell trees, and some of these were "gros arbres," and the account shows that the cutting must have been done with somewhat of expedition. His party had iron axes as well as stone, but our author does not compare the two, but calls them all "meschantes." In describing the customary method of camping when enemies were supposed to be near, he tells us that as soon as the Indians had chosen the place for a camp, they immediately began to cut down trees to make a barricade, and he says that they know so well how to do this that in less than two hours they have so strong a defence that five hundred of their enemies would not be able to break into it without great difficulty and loss of life. Then in another passage he speaks of the Iroquois cutting down trees for a similar purpose. Nowhere does he speak of fire as an aid in the process. Indeed in the first case where he tells us of so strong a barricade, he says that they make no fire lest the smoke reveal their presence to their enemies.

From these and similar accounts it seems quite probable, to say the least, that stone axes were used as axes for cutting timber, and with not altogether unsatisfactory results.

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GROSSE'S CLASSIFICATION AND STRUCTURE OF THE BIRD-LICE OR MALLOPHAGA.[1]

ABSTRACT BY PROFESSOR G. MACLOSKIE.

THE Mallophaga, or bird-lice, are wingless insects with incomplete metamorphosis, mandibulate mouth-parts, two or three-segmented thorax, eight to ten abdominal somites. They live on mammals and birds, feeding on their scales, hairs and feathers. The genera which are found on mammals never occur on birds, and *vice versa.* Redi first observed (1688) that there are some lice with haustellate and others with mandibulate mouth-parts. Nitsch (1842) carefully examined them, and Von Giebel (1874) improved on his work.

Nitsch divides them into two chief groups, Philopteridæ and Liotheidæ; the Philopteridæ have filamentous antennæ and no palps; the Liotheidæ have clavate four-jointed antennæ and palps. The Philopteridæ comprise two families: (1) Trichodectes, the

[1] Beiträge zur Kenntniss der Mallophaga, von Dr. Franz Grosse in Strassburg. Zeitschrift für wissenschaftliche Zoologie, Bd. XLII, pp. 530–558, mit Taf. XVIII (1885).

only genus, characterized by three-jointed antennæ and one-clawed feet; (2) Philopteridæ, *strictè*, with five-jointed antennæ and two-clawed feet.

The Liotheidæ have likewise two families: (1) Gyropus, the only genus, having one-clawed feet; and (2) Liotheidæ, *strictè*, with two-clawed feet.

Trichodectes and Gyropus occur only on mammals, the other genera only on birds, and are classified according to the presence or absence of appendages on the head (trabeculæ) and their motility, to the sexual differentiation of antennæ, their attitude, the form of the head, the consistency of the thoracal somites and the form of the last abdominal somites.

PHILOPTERIDÆ, *strictè*.

1. Trabeculæ motile, antennæ nearly alike in both sexes .... *Docophorus*.
2. Trabeculæ not motile.
   a. Antennæ filiform, no sexual differentiation.
      (a) Hind-head rounded off, terminal somite of male rounded off.. *Nirmus*.
      (b) Hind-head abruptly angled, abdominal somites fused in the middle *Goniocotes*.
   b. Antennæ of male forcipate by a process from the third segment.
      (a) Hind-head angled, terminal somite of female tubercle-like, of male rounded off.. *Goniodes*.
      (b) Hind-head rounded off, terminal somite of male notched ... *Lipeurus*.

LIOTHEIDÆ, *strictè*.

1. Mesothorax wanting, antennæ generally concealed.
   a. Head very broad, no orbital sinus .... *Eureum*.
   b. Head elongated, with lateral angles directed backwards.
      (a) With sharply marked-off clypeus and shallow orbital sinus *Læmobothrium*.
      (b) With only wavy head-margins, and long lateral lobes on the labrum *Physostomum*.
2. Mesothorax present.
   a. Mesothorax large, sharply marked-off, head three-sided, antennæ concealed *Trinotum*.
   b. Mesothorax small, only indicated.
      (a) Orbital bay deep, antennæ mostly elongated and visible. *Colpocephalum*.
      (b) Orbital bay very shallow or obsolete, antennæ concealed.... *Menopon*.

Grosse's researches have been largely on a Liotheid found on a pelican from Chili, closely related to Menopon and forming the type of a new genus and species, *Tetrophthalmus chilensis*. The male is 4–4½^{mm} long, the female slightly less. He also contributes important emendations of our knowledge of the other species.

Head.—In Tetrophthalmus the head is somewhat constricted, is broader than long, slightly convex above, concave below, and somewhat uniform, the occipital angles being rounded off. The hinder limit of the clypeus shows on each side a notch, about a third from the front of the head; two dark spots are seen on each side of the head, the larger one near the notch, the other behind it and outwards. The antennæ lie concealed in a lateral cavity of the under side of the head (as in Læmobothrium, Fig. 1 *at*). Two eyes, whose pigment is seen from above, lie on each side below and behind the antennal cavity. Hairs are distributed over the head, along the borders and on its ventral and dorsal surfaces. On the under side of the head is the funnel-shaped mouth-opening, surrounded by the mandibulate mouth-parts. Grosse describes the mouth-parts of Mallophaga in detail, as previous writers err greatly regarding them.

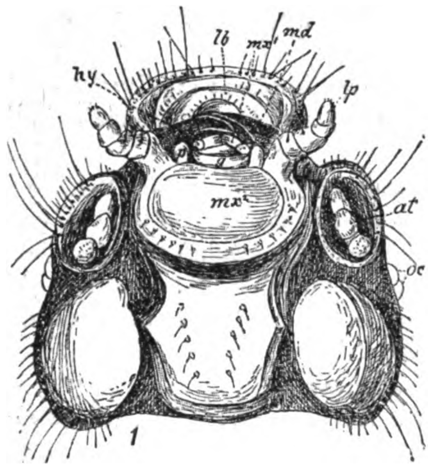

FIG. 1.[1]—Ventral view of head of Læmobothrium from *Gypogeranus serpentarius*. × 30.

Labrum (oberlippe).—This is not, as in other insects, inserted on the anterior border of the head, but in all Mallophaga it is

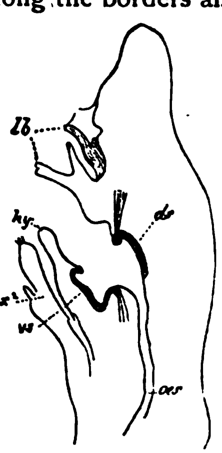

Fig. 2.

Fig. 3.

FIG. 2.—Median section through head of *Goniodes dissimilis*. × 60. FIG. 3.—Labrum of *Goniodes dissimilis*. × 60.

[1] *Explanation of reference letters in the figures.*—*at*, antennæ; *ch*, chitinous bar; *ds*, *vs*, dorsal and ventral parts of œsophageal sclerites; *g*, glossa (ligula); *gs*, glassy body; *h*, hypodermis; *hy*, hypopharynx; *is*, *os*, inner and outer side of maxilla; *l*, lens-shaped chitinous thickening; *lb*, labrum (upper lip); *l.md*, *r.md*, left and right mandible; *lp*, labial palp; *m*, muscle; *md*, mandible; *mt*, mentum; *mx*[1], 1st maxilla; *mx*[2], 2d maxilla (labium or under lip); *oc*, eyes; *oes*, œsophagus; *on*, optic nerve; *p*, paraglossa; *r*, retinal cells.

on the under side of the head. In all Liotheidæ it is similarly formed (Fig. 1 *lb*), being a thin transverse arched swelling, with chitinous margins bearing small bristles. The labrum of the Philopteridæ has a broad disk-like basis fixed on the under side of the head, and is divided by some transverse furrows (Figs. 2, 3, 5 *lb*). There is a broad furrow, separated from the mouth by a plate of chitin, and farther forward a deep narrow furrow, next the anterior boundary of the labrum. In the living animal the labrum is constantly moving; and in Philopteridæ it can adhere to glass like a suctorial disk. The labrum can thus hold on to hairs or feathers.

Mandibles.—As a type we take the mandibles of Tetrophthalmus (Fig. 4). They have each two strong, long teeth, somewhat different in their structure.

The under tooth of the left mandible has a protuberance with curved point and an arched surface; its upper tooth has two points. The right mandible has two stout teeth which fit the left mandible on closing. This serves for cutting particles held between the labrum and the first maxillæ. The large pointed teeth serve for removing dermal scales. The mandibles of the Philopteridæ are long, triangular and two-toothed, the teeth short and thick (especially in genus Docophorus).

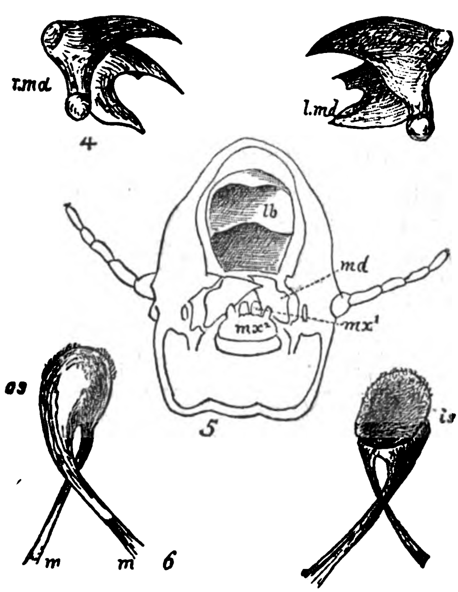

FIG. 4.—Right and left mandibles of Tetrophthalmus. × 60. FIG. 5.—Head of *Lipeurus heterographus*, seen from below. × 60. FIG. 6.—First maxillæ of Tetrophthalmus. × 75.

First maxillæ.—These are conical, and have a basal and a terminal segment or blade, distinguishable in young specimens. The inner side of the blade has hooklets (not in Docophorus) (Figs. 5, 6). The maxillæ seem to take no part in comminuting the food beyond aiding in its prehension. With all care

Grosse has never been able to find the palps of the first maxillæ which Nitsch ascribes to Liotheidæ. Nitsch figures them in *Trinotum conspurcatum*, but this can scarcely be correct, for he places the four-jointed papillæ on the blade near its anterior border. In Tetrophthalmus the palps belong not to the first but to the second maxillæ. The same is true of *Menopon pallidum*, *Colpocephalum zebra*, a Læmobothrium from *Gypogeranus serpentarius*, and a Trinotum from the swift, and probably is the case with all the genera and species.

Second maxillæ (unterlippe).—These are flat, fused, bounding the mouth posteriorly. They consist, in Liotheidæ, of two parts which are united by a transverse fold (Fig. 8). The basal part (mentum, *mt*) represents the coalescing stipites and squamæ of normal first maxillæ, and bears the four-jointed labial palps. The upper part is the ligula or glossa (*g*) corresponding to the inner blade [lacinia]. Laterally on the ligula are the paraglossæ (*p*), corresponding to the outer blade [galea]. A chitinous band limits the glossa where it bears the paraglossa, as if the parts of both had coalesced.

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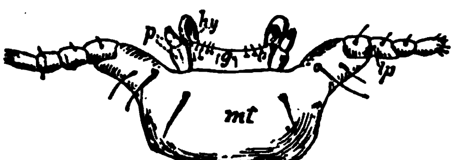

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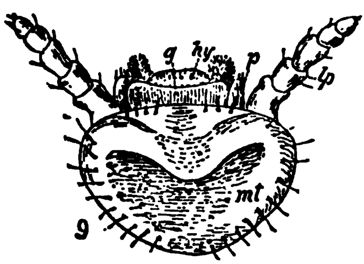

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FIG. 7.—Second maxillæ of Nirmus. × 60. FIG. 8.—Second maxillæ of *Tetrophthalmus chilensis*. × 60. FIG. 9.—Second maxillæ of Læmobothrium. × 60.

Rudow seems to have mistaken the antennæ for the labial palps. Melnikow overlooked the labium, and erroneously compared the products of the œsophageal intima with the proboscis of Pediculina, in consequence of this false comparison referring the Mallophaga to Rhynchota.

The labium of the Philopteridæ has no palps (Fig. 7). It is usually triangular, with rounded angles, and is sometimes very small, as in the genus Lipeurus, the mentum being smaller than the ligule. The ligule is emarginated in Docophorus and Lipeurus. The paraglossæ of Philopteridæ, as in the Liotheidæ, are like tactile-organs, remarkably long in species of Goniodes.

In all Liotheidæ the intima of the ventral end of the oral cavity forms a fold-like duplicature as in Philopteridæ (hypopharynx, Fig. 2 *hy*). In Læmobothrium and Tetrophthalmus this extends forward over the labium, and its lateral borders are strongly bent upwards (Figs. 1, 8. *hy*).

For the study of the head Grosse made transverse and sagittal sections of specimens fresh from molting and hardened in chromic or picric acid. From absolute alcohol they were placed in chloroform and after two hours embedded in paraffine, being kept for a time in melted paraffine under the air-pump. The sections were attached to the slide by means of albumen or oil of cloves, stained by alcoholic carmine-solution, treated with acidulated alcohol so as to show the nuclei, and then enclosed in Canada balsam.

Thorax.—In the genera Trinotum, Colpocephalum and Tetrophthalmus the three thoracic somites are present, especially manifest in the young. The prothorax of Tetrophthalmus has above a rounded swelling, and ends forwards in a bristly point on each side. Within the prothorax, but visible through the transparent dorsum, is a cross-band of chitin, as in Menopon, for the attachment of muscles. The mesothorax is much narrower than the other thoracic somites. The metathorax is of trapezoidal form, and much broader and shorter than the prothorax. The borders of these somites are strongly chitinized. There are no wings or rudiments of wings. The foremost of the three pairs of limbs are the shortest, and they act as foot-jaws, drawing fragments of food to the mouth. In the male Tetrophthalmus they are large and also serve for holding the female. The tibia of all the limbs of the male have their inferior end extending into a knob with sharp processes like a "morning star." There are only two tarsal joints, the distal one being the longer and bearing two incurved claws, inclosing between them a soft lobe [pulvillus]. The bristles on the tibia and the "morning-star" processes of the male serve for holding the female, which indeed often clambers among the feathers of the host.

Abdomen.—The female of Tetrophthalmus has ten abdominal somites, the terminal one soft and rounded. The male has nine, as the last is invaginated so as to serve as a sheath for the penis; the hind end of the male is pointed and more chitinized, and more darkly colored than in the female.

Digestive track.—Two types of crop are found in the Mallophaga. In Philopterida the crop is a lateral diverticulum of the œsophagus; in Liotheidæ it is a club-shaped symmetrical enlargement of the œsophagus. Kramer divides the intestine of Lipeurus into an oral-cavity, an œsophagus, crop, chylus-stomach and hind-intestine. The œsophagus reaches back to the abdomen, and has a homogeneous chitinous intima. The intima of the crop has spines, and its cells appear to secrete a fluid. The chylus-stomach extends to the entrance of the malpighian tubules. Grosse finds in the œsophagus of Tetrophthalmus, behind the hypopharynx, a chitin-bar produced by thickening of the intima, consisting of a groove-like mid-piece, and running forward and backward into two diverging branches. The hind branches have muscles from the occipital border of the cranium. These chitinous bars are not haustellate, but support the oral intima, and in their groove are sent along comminuted fragments of feathers, retained by the retrorse spines and denticulations of the dorsal part of the intima.

Goniodes has two squamous œsophageal pieces, a dorsal and a ventral (Fig. 2, *ds*, *vs*). The ventral piece has posterior processes joined by muscles with the occipital border. The dorsal piece sends forward a muscular bundle, which bifurcates and its divisions are inserted on the anterior cranial border. Two ducts (probably salivary) run forwards through these scale-like pieces, uniting into one. The chylus-stomach is cordate at its beginning, and has no chitinous intima. The hind-intestine has six longitudinal grooves, and rectal glands with richly branching tracheæ and a chitinous intima.

The mode of nutrition of Mallophaga is not fully ascertained. Nitsch stated that they eat the epidermal products of birds and mammals, and sometimes blood. Grosse finds that blood is rarely taken, and only in cases where the bearers (birds) are so injured or diseased as to have blood among their plumage; and Leuckart gives the same result as to *Trichodectes canis* of the dog. In Læmobothrium, Grosse found the intestine filled with the limbs of its own kind, as if it ate the product of its own molting.

Malpighian vessels.—These are four, not branched; have a lumen and ganglion-cells (not separated from the lumen by any membrane).

Salivary glands.—There are two pairs; and exceptionally the Philopteridæ have one-celled glands as on the crop. Grosse found one of these cells undergoing division. The salivary organs include salivary glands and salivary reservoirs. The glands usually adjoin the crop or stomach, and have a cell-layer with nuclei, covered externally and internally by a fine homogeneous epithelium. Before the entrance of thin ducts into the œsophagus, a gland and a salivary vessel unite into a common duct.

Sexual organs.—The male sexual organs are of the usual type of insects, paired testes, spermatic ducts, a seminal vesicle, ejaculatory duct and penis. Nerves supply the seminal vesicle and ejaculatory duct; and in Tetrophthalmus the terminal somite of the abdomen is withdrawn so as to be concealed, serving as a sheath for the penis. The female organs consist of paired ovaries (three pairs of ovarian tubes in Liotheidæ, five pairs in Philopteridæ), two oviducts uniting into one and a seminal receptacle. The egg-case has a lid which springs open at the exit of the young insect.

Respiratory apparatus.—There are seven pairs of stigmas, one in the prothorax and six abdominal. Each stigma has internally a crown of fine hairs to protect from impurities. A pair of strong longitudinal tracheæ send branches to the stigmata and are united to each other by a strong cross branch in the abdomen, and smaller ones in the head and thorax.

Dorsal vessel.—Grosse could not succeed in making a preparation of this, but in the recently molted living animal it can be seen pulsating through the back.

Nervous system.—This consists (in Philopteridæ) of two cephalic ganglia and three thoracic ganglia. The preœsophageal ganglion is much larger than the subœsophageal, and they are united by strong commisures. The last thoracal ganglion is large, and sends back nerves to supply the abdomen.

Antennæ.—In Liotheidæ these are four-segmented, club-shaped or knobbed, the terminal segment spherical, lying in a hollow of the sub-terminal one (Fig. 1 *at*). In a cross-section of the terminal segment of Læmobothrium are seen round nucleated cells, apparently ganglionic enlargement of nerves. The Liotheidæ have the antennæ alike in both sexes, but in Philopteridæ the third segment of the antennæ of the male has a lateral process, sometimes so large as to make the antenna resemble a lobster's claw. Nitsch states that it is for holding the female.

Eyes.—These lie on the margin of the under surface of the head behind the antennæ. Authors have hitherto ascribed a single pair ol eyes to all Mallophaga. But in all Philopterid genera examined (Goniodes, Docophorus, Lipeurus, Nirmus) the author found a single pair, and in all Liotheid genera (Tetrophthalmus, Læmobothrium, Menopon, Trinotum and Colpocephalum) he found two pairs of stemmata. If this character holds good for the remaining genera it will still further separate the two chief divisions of the Mallophaga.

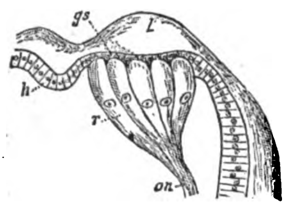

FIG. 10.—Eye of Læmobothrium seen on cross-section of head. × 190.

The eyes of Mallophaga are simple, provided with a lens-shaped thickening of the cuticle. In young specimens the eye has no pigment, but in older specimens it has pigmented retinal cells. The eye of Læmobothrium, examined by means of sections, has, under the chitin-thickening (Fig. 10 *l*), twenty-four pigmented retinal-cells (*r*), clavate and nucleated with nucleoli, merging gradually into the pigmented optic nerve (*on*). Each eye is directly innervated from the preœsophageal ganglion. The hypodermal cells are interposed between the lens and the retinal-cells, as cubic cells in old specimens, but as a hyaline body consisting of cylindrical cells in young or recently molted specimens. There are no rhabdites in the eyes. The eyes of Mallophaga resembles those of *Phryganea grandis*, as described by Grenacher.

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TRACK OF A CYCLONE WHICH PASSED OVER WESTERN INDIANA MORE THAN THREE HUNDRED YEARS AGO.

BY JNO. T. CAMPBELL.

LAST April (1885) I was surveying in the west-central part of Parke county, Indiana. On the south side of Section 16, Township 15 north, of Range 8 west, I noticed that the tree graves were very numerous, there being one to every square rod of ground. I noticed that they all indicated that the storm which caused them was going to the north-east. When a tree is blown down the roots hold two to five cubic yards of earth in their grasp, which makes a corresponding pit where the tree stood; after the fallen tree has entirely rotted, the earth held by the roots leaves a mound resembling an old grave, and have been very commonly called by people here, "Indian graves." The mound is always on the side of the pit toward which the tree fell.

This storm track was about one thousand feet wide. I at that time followed it nearly one mile. Just before I ceased tracing it I found the stump of a white oak, cut down during the year 1884, standing on top of one of the tree graves or mounds. I counted the rings of growth and found it to have been two hundred and ninety-seven (297) years old. That settled the fact that the storm had passed over the ground at least three hundred and ten years before; for the acorn could not sprout on the mound until the tree had first been blown down; and second, it could not sprout till the fallen tree had also rotted away, and left the mound sufficiently flattened for moisture to rise to its top surface.

On the 18th of May following I was surveying in Section 29 and 30, Township 15 north, of Range 8 west (which surveyors in the West will understand is about three miles to the south-west of the first place mentioned). Here I also found the tree graves as thick as the grown trees now are, and they also indicated that the storm which blew down the trees which made these tree graves, was going to the north-east. A moment's reflection also showed me that this was on the same line or track of the one first observed.

After I returned home I placed a string on my county map so as to cover these two locations, and noted carefully what points across the county the string touched. I noticed that by extending the string south-westward it passed about one-half to three-quarters of a mile to the right of Clinton, in the south end of Vermilion county, which adjoins this county on the west, the Wabash river lying between them. Clinton stands on the west bank of this river. I at once remembered that when a boy in my early "teens" I had lived with a Dr. Kile, two and a half miles south-west of Clinton, and in my frequent trips to town I often noticed the tree graves, which in my simplicity then I supposed to be in fact real "Injun graves." They were very numerous, and I supposed there had been a great battle between two hostile tribes of Indians, and that these mounds were the graves of the unknown braves. There were not the very faintest trace of fallen trees in connection with these graves, so thoroughly had they rotted away. I found by applying the string to the map that these graves were in a line with those I had recently found in this (Parke) county.

On the 8th of July following (1885) I was making a survey in the north-east part of the county, in Section 29, Township 17 north, of Range 6 west. While at the dinner table I told one of the land proprietors that I had recently got upon the track of an ancient storm which, if it had kept on the course I had observed should pass over the ground we were then eating our dinner on. I asked him if he had ever noticed any trace of it. He said, "Yes. When I was a boy and young man the 'Indian graves' out in that field [pointing south-eastward] were so thick that I could jump from one to another all over that part of the farm." I asked what course the storm was going, and explained how he would know by the position of the mound in relation to the pit. He said north-east, and told me what farms it crossed, and about where it crossed the county boundary into Montgomery county, which was close by. This was over fifteen miles from where I had first discovered the track, and I had not missed its location where I am now speaking about more than seven hundred feet.

The next day I was going to another part of the county, and had to travel south-westward several miles, and crossed the storm track. I saw a man in the edge of a field harvesting. I told him what I had discovered, and asked him if he had ever noticed it. He answered, "Yes. When I was a boy the Indian ('Injûn') graves just below that sugar camp [grove of sugar maples] were as thick as stumps in a new clearing. We boys used to count them to see how many Indians had been killed in battle." It was the general belief of the children of the early settlers that these were Indian graves, and that where they were numerous, as in a storm track, that there had been a battle between tribes. The place he pointed out was in the track I was looking after.

I may here remark that after the land is cleared and cultivated, the plow in a very few years destroys all trace of these graves. Hence my inquiries of persons who had known the country from the days when it was an unbroken forest.

This storm would pass, in going north-east, about two miles to the left of the city of Crawfordsville, Indiana, the county-seat of Montgomery county. Though it might change its course farther on.

At, or very near the spot where I counted the age of the oak which had grown on one of these tree graves, there still stands on another mound a white oak considerably larger than the one I counted, though it may not be an older one. I have delayed writing this account over six months, expecting a miller to cut this larger tree so I could count its age, but it has been neglected so long that I have decided to write from what information I now have.

These tree graves are, in the wild forest, as well preserved and as distinct in outline, although more than three hundred years old, as many that have been made by trees that have fallen within my own recollection. If the same conditions that have so well preserved them for that time should continue in the long future, I see no reason why these mounds might not be preserved five thousand, yea, ten thousand years.

What does the reader guess has so well preserved these little mounds for so long a time? It is nothing more nor less than a thin coating of forest leaves. The leaves act as shingles in shedding the rains, so that they are not washed or worn down by the falling rain or melting snow. The frost does not penetrate through a good coating of leaves, and therefore they are not expanded and spread out by freezing and thawing. I can see a great difference between the mounds in the wild forest and those on land that has been set to grass and pastured a few years. The tramping of stock and the frequent expansions from freezing, which the grass does not prevent, flattens them perceptibly. The grass, however, does preserve them against rain-washings. When a belt of forest is blown down there are no trees to produce leaf shingling till a new set are produced; but these come in great abundance in ten years. It requires about fifteen to twenty years to rot a sound white oak. The time will depend on the lay of the log, whether it falls across another log and lies above ground, or lies on or is partly bedded in the ground.

I now offer a conundrum in connnection with this subject for whomsoever may feel an interest in it to solve. I have partly solved it myself, but not entirely to my satisfaction. I have, after much observation, noticed that not more than one-tenth of the surface of the present forests show any trace whatever of any storms, recent or ancient. If storms have been as frequent and as destructive in the past as in my day (of fifty-three years), and the elements of preservation of the mounds have existed in the past as now, why do I find so few storm tracks as I have mentioned? It would seem that in three hundred years, if storms had always been as frequent as in our time, and in the same haphazard manner, there would not be a square rod of ground that would not show some trace of a storm.

I give my explanation for what it may be worth, but is short of all the facts of explanation. I am able to say of the storm I have described, with as much confidence as if I had been present and seen it: First, that it occurred when the trees were in full leaf; second, that there had been a protracted rain; third, that many of the trees blown down were white oak; fourth, that one was a large poplar; and fifth, that very few, if any at all were black walnut. And for the following reasons: The *great* storms do not now occur before the leaves are on. Without the resistance against the wind offered by the leaves, it is very hard for any storm to uproot a green tree. If the ground is dry and hard, or frozen, the trees will break off at or above ground. And in such case they would leave no tree graves, which may account for the few tracks I find. An oak leaves a deep, round pit and a plump, round mound. A poplar leaves a broad, shallow pit and a long, slender mound. The black walnut is very rarely "blown up by the root." I have seen this country from an unbroken forest to the present time, when four-fifths of the land is cleared for the plow or pasture, and I don't remember that I ever saw a black walnut blown up by the root. I have seen many broken off. They have a very firm root, and are, when mature, a little doughty at the stump, but very sound from ten feet above ground upward.

I have seen and still know of other large trees which stand on the graves of former fallen trees. Some of these trees are very large, but the size of a tree is such an uncertain indication of its age, that I can't say with much certainty how long the mounds, on which they stand, have existed. One thing is certain, the mounds are older than the trees. At the Fair ground, a mile west of where I am writing (Rockville, Indiana) are several such cases, and on the grounds of the now growing famous resort in our county, "Turkey run," or as it is called by people away from here, "Bloomingdale glens," are several such cases.

In a future article I shall show how the forest leaves have preserved the sides of hills and thus allowed the small streams to cut out the bottoms of the hollows deep, steep and sharp, which are rapidly changing since the country has been cleared and farmed. Also how they have preserved the ancient beds of streams along the terrace bottoms of the Wabash river and its principal tributaries till they are as sharply defined after the lapse of no one can venture to guess how many thousands of years, as they were when the last great final flood that cut out the beds swept over these plains.

I have said the storm here described was a cyclone. This I infer from the way the trees had fallen. In some parts of the track the trees were thrown in every direction, and the course of the storm could only be determined by the general course of the track, and not by the fall of individual trees.

The course of this storm is N. 44° 30′ E. in this county. In all my recollection of storms I never saw but one (in 1883) which bore so much to the north, and that one was the most threatening and awful in its appearance I ever saw, and did in localities much damage. Its course was about N. 37° E., or about 7° 30′ more north than the ancient one. The great majority of the storms I have seen, and of those which have left plain tracks, are from a few degrees north to a few degrees south of west.

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ON THE MOUNTING OF FOSSILS.

BY FRANKLIN C. HILL.

THE five expeditions which have gone to the far West from Princeton have brought in many valuable fossils—invaluable is perhaps the better word—chiefly remains of vertebrates.

For the double purpose of utilizing and of preserving these treasures they have been mounted in a manner new in this country, and it is believed not common abroad, though somewhat practiced there.

The leading idea of the system is that each piece shall be set up in its natural position.

Our museum now contains nearly 400 such specimens, which have attracted much attention and admiration from visitors, both scientific and lay, and I have been often urged to publish some account of my methods and results.

Although many fossil bones are whole and clean when found, many more of them are broken and more or less clogged with matrix. The freeing of this last and the mending of the broken are troublesome and delicate tasks. Mallet and chisel come into play, their sizes depending on the nature of the case. For the heavier work ordinary stone-cutter's tools can be used, yet it is commonly better to make haste slowly and use needles, and no needle is more useful than a No. 1 sharp. By wrapping the eye end of the needle with a narrow strip of paper it can be made to fit in the clamp of a patent sewing haft, and a chisel made, which with a dogwood stick of from one to one and a-half inches diameter and nine inches long for a mallet, is capable of doing very delicate work, and also much which at first sight would seem to be entirely too heavy for so light a tool.

For reaching into the deeper cavities a No. 12 knitting needle, well set into an awl handle, is needed, while for cleaning out the carapaces of turtles it is well to have special long handles made. Darning needles are of convenient size but of too poor a quality of steel.

But whatever needle is used, a good oil-stone should always be at hand to renew the point as often as it is blunted. By a little practice a point can be put to a needle much better for this work than the original one.

A good stiff tooth-brush is needed, a good lens, say Tolles' one inch triplet, and a hand mirror to throw light into cavities of heavy specimens that cannot be easily turned.

A high workbench with vise, plyers, anvil and hammers, drills, a flat cushion to lay specimens on while being worked, and an assortment of wire complete the "kit" of tools, but a pot of mucilage and a box of calcined plaster are also needed for mending the broken. It is best to have always a number of specimens on hand so that the mended can be allowed to dry without delay to the work.

Of the cements that we have tried at Princeton, we have given up all but the one which we began with, recommended to us years ago by Professor R. P. Whitfield, and published by me in the *Am. Jour. Pharmacy*, May, 1875. It is: Starch one part white sugar four parts, gum arabic eight parts and water q. s., boiled together after the manner of an apothecary. Latterly we have added a small quantity of salicylic acid to prevent fermentation. It should be about as thick as honey, and for joints that do not fit neatly it is well to thicken it at the moment of using with plaster of Paris. For filling large voids plaster enough should be kneaded in to make a stiff putty, and it is well to work in with it as many pieces of stone or brick as possible, both to save material and to lessen the shrinkage of the mass.

Although I sometimes paint the masses of plaster which show themselves, to destroy the unpleasant violent contrasts of color, I always use some neutral tint entirely different from the color of the fossil, in order that the false parts can be easily distinguished.

With the outfit described, a smooth-grained and moderately hard matrix and good hard bones the work is pleasant and easy. But when the matrix is of cemented gravel, here hard as flint, there loose sand, with soft and crumbly bones, a large stock of patience and good temper must be laid in also.

When the bone is freed from the matrix and mended, the question comes up as to how to keep it safely and show it to advantage. If economy of space be important, a drawer just deep enough to receive it is perhaps the best receptacle; but if we wish to exhibit it to the public a glass case is needed.

To ordinary observers, and even to pretty fair anatomists, bones on a tray or shelf say little. In a museum the inexpert visitor must, for obvious reasons, be considered as well as the student and professor, and experience shows that a bone in its natural position, even if alone, is easier to understand than when reversed, while if several bones are combined so as to form a foot, or leg, a spinal column or a skull, the value of each is greatly increased. Following out this idea I have been led to mount every skull, or limb, or bone, or even fragment of a bone which has character enough to be worth preserving, and have obtained results better than my hopes.

A single ramus of a lower jaw lying on its side in a tray shows but badly, and is liable to be thrust aside and jostled, to the great danger of its teeth and coronoid. But hold it in its natural position, and note its length and width. Then have a neat block of some hard wood, say cherry or black walnut, cut and polished with shellac, not varnish, and selecting a wire of suitable size, make two hooks, like Fig. 1, to fit the jaw near its ends, set them up in the block, slip the jaw into them and it speaks for itself, and is safe. Of course the block must always be just so large that no part of the bone will overhang the edge, and then the specimen will not be injured by crowding it against the wall or another specimen. If larger than needed it wastes shelf-room. If the specimen be large and heavy, or at all crumbly, the supports need to be wrapped with cloth or felt to protect it.

Fig. 1

Fig. 2

Suppose we have both rami, or the greater part of them. Mend the breaks with the cement, and when dry bend two stout wires as in Fig. 2, one to bind the jaws together at each end, cement them in place and let them dry. Then set up three wire hooks to receive these braces, as at *b* and *c*, Fig. 3, one in front and two behind, as far apart as the jaw will allow. The use of these hooks is so obvious that the most careless or dull student can hardly fail to see it, which is a good thing, because if a

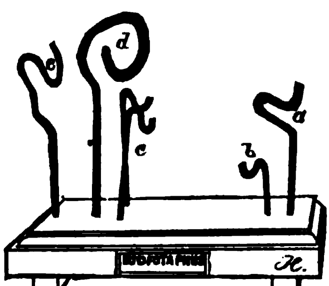


Fig. 3

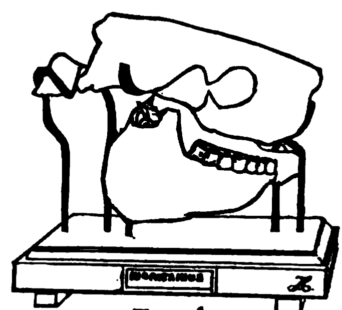


Fig. 4

Skull and atlas, eight and a half inches long.

blunder be possible some persons can always be depended on to make it, and hence come many breakages. If beside the jaw we have the skull, we need two more wires, one to catch the back of the skull at the glenoids (Fig. 3 *d*), and the other to support the nose (*a*).

In this specimen the sixth wire (*e*) carries the atlas, as shown in Fig. 4. When it came from Dakota it was a solid block of stone with corners of the bone sticking out, and it was worked apart entirely with needle and mallet.

Take another case (Fig. 5). Here are almost all the parts of Hyænodon's hind leg and foot, with part of the pelvis, a chaos as they lay in a tray. But by first glueing the tarsals together in position and making them a bed on a plaster base, and then bedding each metatarsal and phalanx in turn, I was able to display the foot. The tarsals were then set free by soaking in water. Fastening this plaster base to the black walnut pedestal by a screw-bolt, I set up behind it a post, eighteen inches high, into which wires were set, as shown in the figure. The small figures behind show the wires as seen from above "in plan." The main curves in *a* and *b* hold the tibia and their ends catch the fibula. Patella sits in the loop of *c*, *d* and *e* steady the head of femur, while *f* and another wire behind the post hold the pelvic fragment. Each bone is marked with the museum number of the specimen somewhere on its surface.

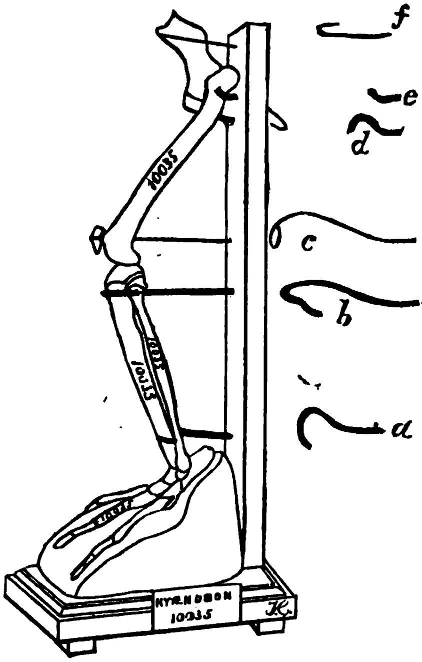


FIG. 5.

The adjustment of these wires is a nice matter. Each bone must have its natural position, but must be under no strain; must be held in its place securely, and yet be so free as to be easily lifted out. It must stay by gravity only.

For small specimens all that is needed to secure the wires in the pedestal or post, is to bore a clean hole a trifle smaller than the wire and force the wire into it, taking care not to turn it in the hole afterwards. For heavier bones, where wire of one-eighth inch and over is used, it is better to cut a thread on the wire and screw it in.

Some practice is needed to bring the wires to their proper shape. No two bones are ever quite alike, and hence each wire must be fitted to its own place by experiment. When a new curve is put into one end of a crooked wire the path of the other end through space defies mathematics.

With heavy bones it is sometimes hard to make them rest in their supports without strain, though it can be done. We have an enormous femur of a mastodon which seems to be held up by a post behind it, while really the whole weight is borne by a plaster base in which the condyles rest, and the upper end does not even touch the post or the guard wires. The hind leg of Loxolophodon is mounted on a plaster base of the computed height

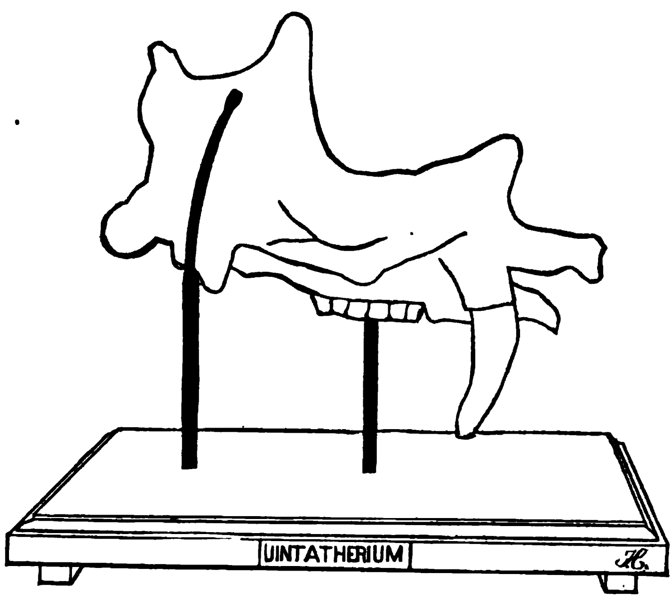


FIG. 6.—Skull, thirty-one inches long.

of the foot, which takes so much of the weight that there is no strain on the rod which guards the head of the tibia.

We have now five mounted skulls of the Uintatherium family, and their mountings give a fine example of evolution. The first one is sustained by five distinct iron rods whose flat feet are secured by sixteen screws to a painted pedestal of white pine, the irons weighing over eight pounds.

The last one, a much larger and finer specimen, is carried by two rods screwed into the black walnut pedestal. The rearward rod (Fig. 7) sends off a branch from each side just below the felted saddle in which the basioccipital rests, which branches curve upwards and press against the bases of the rear horn-cores, so-called, and hold all firmly in place. The front iron has a small square button on top, felted, on which the roof of the mouth rests. These irons weigh four pounds.

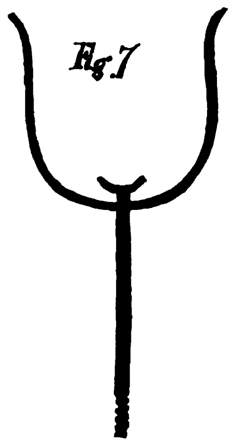


Fig 7

While it is of course impossible to fix a maximum for the size of pedestals, a minimum is a good thing to have, and I have fixed on 3 in. × 1½ in. × 1 in. high. This gives room for a good sized label on the side, giving genus and species, geological formation, locality and catalogue number.

For very small jaws, single small teeth, &c., I set up a small cylinder of plaster on one of the smallest pedestals, and cement the specimen to the top of it. In other cases, as in *Didelphys pygmæa* Scott, and the Acip-rion jaws shown in Fig. 8, the slab of matrix is cemented to the surface of a board hung on two pivots, so that it can be tilted to either side for ex-examination. And when a new specimen shows new features I devise a new mounting to suit them.

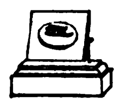


Fig 8

3 PEDESTAL IN LONG

——:o:——

RECENT LITERATURE.

CROLL'S CLIMATE AND COSMOLOGY.[1]—In this volume of essays, Mr. Croll reaffirms his physical theory to account for the glacial climate in a way to command the attention of every geologist and in a manner which will attract the interest of the lay reader. The discussions relate to questions of the deepest interest, and the arguments used are certainly strong ones. Mr. Croll's peculiar views as to the existence of glacial climates before the Quaternary period are restated with much fullness, though he candidly admits that most geologists are opposed to them.

The author's theory is usually called the "eccentricity theory," but he prefers to call it the "physical theory." He states that a high state of eccentricity of the earth's orbits will not necessarily

[1] *Discussions on Climate and Cosmology.* By JAMES CROLL, LL.D., F.R.S. New York, D. Appleton & Co., 1886. 12mo, pp. 327. $2.

alone produce a glacial epoch, but that from the first he has "maintained that no amount of eccentricity, however great, could alone produce a glacial condition of things," but that "the glacial epoch was the result, not of a high state of eccentricity, but of a combination of physical agencies, brought into operation by this high state" of eccentricity. One of the most important of these agencies is, he thinks, the enormous amount of heat conveyed from equatorial to temperate and polar regions by means of ocean currents, and the deflection of this heat, during a high state of eccentricity, from the one hemisphere to the other. But all this depends on ocean-currents flowing from equatorial to polar regions, and the existence of these currents, in turn, depends, to a large extent, on the contour of the continents and the particular distribution of sea and land. Take, as one example, the Gulf stream, a current which played so important a part in the phenomena of the glacial epoch. A very slight change in geographical conditions, such as the opening of communication between the Gulf of Mexico and the Pacific, would have greatly diminished, if not entirely destroyed, that stream; or, as I showed on a former occasion, a change in the form or contour of the Northeast corner of the South American continent would have deflected the great equatorial current, the feeder of the Gulf stream, into the Southern ocean and away from the Caribbean sea. One of the main causes of the extreme condition of things in Northwestern Europe, as well as in eastern parts of America during the glacial epoch, was a large withdrawal of the warm waters of the Gulf stream, and this was to a great extent due, as I stated in my first paper on the subject,[1] to the position of Cape St. Rogue, which deflected the equatorial current into the Southern ocean. That a geographical distribution of land and water, permitting of the existence and deflection of those heat-bearing currents, is one of the main factors in my theory, is what must be obvious to every reader of Climate and Time."

Dr. Croll maintains that, with the exception of those resulting from oscillations of sea level, the general distribution of sea and land and other geographical conditions were the same during the glacial epoch as they are at present. Thus he does not accept Lyell's theory of an elevation of northern lands; yet we do not see but that this was a matter of fact. Indeed, Mr. Croll's speculations produce the impression that he is somewhat one-sided in his treatment of these theories. His knowledge of general geology, and especially of palæontology, is apparently slight. For as regards his theory of interglacial climates in times preceding the Quaternary, the view is opposed to the whole mass of facts in palæontology. The more we have read of Dr. Croll's eccentricity theory, the less necessary does it seem; the geologist had better

[1] Philos. Mag. for August, 1864.

rely on purely geological causes; they may yet be proved to have been sufficient. Dr. Croll nowhere explains why so large a portion of the subpolar regions were unglaciated.

In his discussions in cosmology, Dr. Croll contends that Sir William Thomson and others are wrong in maintaining the "gravitation theory," *i. e.*, that the sun cannot have supplied the earth with heat, even at the present rate, for more than about 15 to 20,000,000 years. He discards this theory, and freely gives the evolutionists and geologists all the heat they want, by claiming that the sun's heat was originally derived from motion in space; this being "more in harmony with the principles of evolution than the gravitation theory, because it explains how the enormous amount of energy which is being dissipated into stellar space may have existed in the matter composing the sun untransformed during bygone ages, or, in fact, for as far back as the matter itself existed."

On page 65, Dr. Croll, it seems to us, too hastily assumes that the ice in the interior of Greenland is of great thickness, while the land itself is low, "probably not much above sea-level." On the contrary, as the result of recent Danish exploration, Dr. Rink tells us, the surface of the ice in the interior is 6000 feet above the sea, while we infer from his statements that the thickness of the ice is not much over 2000 feet. In fact, the theoretical glacialists go to extremes; closet speculations and field-work do not always harmonize.

The only typographical errors we have noticed are the mention of "Heyes" for Hayes on one occasion, while Torell is wrongly spelt "Torrell," in the only instance in which it is used.

LEUNIS' SYNOPSIS DER THIERKUNDE.[1]—This is a new edition of Leunis' Zoölogy, which for so many years has been in almost universal use in the German gymnasia and many of the universities. The present work contains two large volumes of more than 1200 closely printed pages and 1000 cuts each. Perhaps the greatest advantage of Leunis' system was that by the use of series of analytical keys animals could be determined much as the student analyzes flowers with Gray's Botany. This alone would render the book invaluable to any one who wishes to begin the study of a new group or to determine quickly an animal belonging to an unfamiliar class. The book is, of course, intended for German students, but is also quite complete for the marine invertebrates of the North, Baltic and Mediterranean seas. But it contains representative species of most of our American genera. Professor Ludwig, whose work on Echinoderms is known by all zoölogists, has revised the edition and has completely rewritten the second volume, which treats of the inverte-

[1] Third edition, revised by Professor LUDWIG, of Giessen.

brates. This is itself a sufficient guarantee of the scientific accuracy and value of the work. The analytical tables are brief and concise, yet not more technical in language than is absolutely necessary and can be readily understood and followed by the average student. But the book is no mere analytical key to the animal kingdom. The anatomical character of each type, class and order are briefly but clearly presented. It is a hand-book which every teacher will find useful in his class-room and laboratory and which is worthy of a place by the side of Claus or Carus and Gerstæcher in every zoölogical library. The style is clear enough, so that the book could easily be translated by any one tolerably familiar with German. The cuts are clear, good and well selected. The type is rather small and the paper thin, but if large type and thick paper had been used, we should have four or five volumes to contain what is now by a marvel of compression crowded into two. Even more marvelous than the condensation is the price, only thirty marks for the two volumes.—*J. M. Tyler.*

BEDDOE'S RACES OF BRITAIN.[1]—This work gives the fruits of a continued examination of the complexions of large numbers of the natives of Britain, with a view to ascertain the proportion in which the various races, aboriginal and immigrant, are represented in the present population. The volume is to a great extent an expansion of a manuscript essay which in 1868 carried off the great prize of the Welsh National Eisteddfod, and is the outcome of a great part of the leisure of fifteen years. The method adopted was to take notes of the colors of the hair and eyes of persons met or passed at a sufficiently small distance to permit of observation. Those under age, those whose hair had began to grizzle, and those who seemed to belong to the upper or migratory classes were neglected. Eyes are distinguished as light, neutral and dark; hair as red, fair, brown, dark and black; and an index of nigrescence is adopted, forming a basis on which the results of the observations are mapped so as to speak to the eye. A considerable number of head-measurements were also made.

The book is a mine of information, bristling with statistics, facts and arguments, but unfortunately is scarcely comprehensible save by those who know nearly as much of the history and philology of the ancient races as does the author.

ZITTEL'S HANDBUCH DER PALÆONTOLOGIE.—We have from time to time drawn attention to this valuable work, which is being published in parts. It covers the plant and animal kingdoms, and is the most authoritative and recent work on the subject. Due credit is given to American work and illustrations. The number last received (Bd. I, Abth. ii, Lief. 4) is devoted to the fossil Crustacea,

[1] *The Races of Britain.* A contribution to the anthropology of Western Europe. By JOHN BEDDOE, M.D., F.R.S. London, Trubner & Co., Ludgate Hill, 1885.

including the trilobites and Merostomata. The illustrations are abundant and in most every case well engraved. The pages given to the Merostomata, the Phyllocarida and the lower Macrura are full and fresh in treatment. Each order is defined; a brief general account of the external anatomy follows, with remarks on the opinions of different authors as to their classification. The families and genera are defined, the leading types are figured, and then follow tables showing the geological distribution of the species. The author is usually critical in his mode of treatment, as seen in his doubtful recognition of Brachypyge as a Carboniferous crab, which, since the publication of this part, has been shown to be a pedipalp arachnidan. We do not see why, even in the light of Meek and Worthen's excellent treatment, Anthrapalæmon should be placed in the Penæidæ. Still the author's thoroughness and command of the literature is evident throughout the work.

FAXON'S REVISION OF THE CRAWFISH.[1]—This is a systematic treatise on the crawfish of the Northern hemisphere, based chiefly on the material in the museum at Cambridge, which now possesses all the known species from Europe and Asia, and all the American species, with three exceptions. The richness of the material may be realized by the fact that twenty new species of Cambarus are described, whereas Dr. Hagen, in his well-known memoir on the North American crawfish, described but ten unknown to previous authors.

The treatment of the material by the author, as may have been expected, is thorough, and the illustrations, drawn by Mr. Paul Roetter, are excellent. It is a matter of great interest to be able to study such a group as this, scattered as it is through the northern portions of the New and Old World. It is to be hoped that our naturalists will endeavor hereafter, in making out our American fauna, to compare it with that of Europe and particularly Eastern Asia.

GRABER'S ANIMAL MECHANICS.—This forms a double volume in a German series, entitled, Das Wissen der Gegenwart, devoted to popular knowledge relating to science, history and literature; each volume costing but a single mark or twenty-five cents.

The present volume is devoted to the mechanics of the external organs of vertebrates and invertebrates. The author is well known as an authority on the mechanics of motion, etc., of the Arthropoda and has given us what we have found to be a most useful and interesting volume, quite out of the ordinary line of works on natural history. It is abundantly illustrated with novel and graphic sketches, usually well drawn. The topics treated under Vertebrates are the mechanics of the

[1] *Memoirs of the Museum of Comparative Zoölogy, x, No. 4.* A revision of the Asticidæ. By WALTER FAXON. Part I. The genera Cambarus and Astacus. With ten plates. Cambridge, August, 1885. 4to, pp. 186.

external organs in general; the construction of the vertebrate machine and the chief levers; the mechanism of the jaws; the equipment of the jaws (teeth and beak); mechanism of the other mouth parts (tongue, lips, trunk and muzzle, muscles of the ear); the limbs, especially the human hand; and the limbs as organs of locomotion. In treating of the invertebrates, the modes of locomotion, of mastication, stinging, etc., are discussed.

French's Butterflies of the Eastern United States.—At length we have a handy book giving descriptions of all our Eastern and Southern butterflies. The work appears to have been faithfully done, the information given is elementary, and the clear type, simple language and excellent illustrations, with the preliminary account of the transformations of butterflies in general, the best mode of collecting, killing, preparing for the cabinet and of rearing them, render the book an excellent manual for the beginner. An analytical key and glossary also add to its usefulness.

The author is indebted to Mr. W. H. Edward's great work for nearly all the descriptions of the early stages, and follows the classification and nomenclature of that author.

The criticisms we have to make are slight. We would have preferred to have the specific names, at least those not derived from proper names, begin with a small capital, or, when lower case is used, in lower case type. The original engravings are excellent. We should like to have had a larger number of species figured. We trust this may be done in a second edition, which we feel sure will be soon needed.

Government Publications.—Major Ben. Perley Poore is the author of a ponderous quarto of 1392 pages, bearing the following title: A descriptive catalogue of the Government publications of the United States, September 5, 1774, to March 4, 1881; compiled by order of Congress; Washington: Government print, 1885. Inasmuch as the aborigines of our country have been the object of concern to the Government from its beginning, there has never been a year in which valuable ethnological publications have not been issued. The titles of these may be followed up in the volume itself chronologically, or in the index under the word Indian the reader may find at once what he wishes. Other anthropological publications of equal importance to those named, treating of slavery, immigration, treaties, tariff, are here pointed out by title. Indeed, the whole work is an index of anthropology. Fortunate will the student be who can secure through his senator or representative a copy of the descriptive catalogue.

GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

AMERICA.—*The Goajira Peninsula.*—F. A. A. Simons contributes to the Proceedings of the Royal Geographical Society an account of the Goajira peninsula, to the west of the Gulf of Maracaybo, in the United States of Colombia. This large peninsula appears to be tenanted only by less than 25,000 Indians, who are divided into several castes, and have some peculiar laws. Every Indian belongs to the tribe of his mother, and, if he injures himself in any way, he has to pay blood-money to his mother's relations for shedding the blood of his family, and tear-money to his father's relatives for the sorrow he has caused them. The southern part of the peninsula is a level, grassy plain; the northern, a country of volcanic hills, with three ranges, the highest about 2800 feet high. There are no perennial rivers on the peninsula, so that in summer—the greater half of the year—the only water is from wells and a few water-holes, natural or artificial. The weapons of the Goajiras are the bow and arrow, as well as the flint-lock and the rifle. Poisoned arrows are used to some extent. The poison is putrefied animal matter, and the arrow-head the barbed weapon of a sting-ray, so attached to the shaft that it will remain buried in the wound it has made.

American News.—Lieutenant H. F. Allen and Sergeants Robertson and Ficket crossed last year from the head-waters of the Atnah to those of the Sarranah, descended this river to the Yukon and the latter to the sea. The *Corwin* brought these travelers to San Francisco, and also took up Messrs. Garland and Beatty, two Englishmen who had crossed from the Mackenzie to the Yukon and descended the latter.

ASIA.—*Col. Prejevalsky's Journey.*—A letter from Col. Prejevalsky relates to his journey from Lob-nor to Khotan. The few people of Lob-nor are the last remnant of the natives of Lob, a city which was destroyed at the end of the fourteenth century. The Cherchen-daria is a shallow river, margined with a belt of bushes and herbs, all thickly covered with loess dust. The only tree is a poplar, thirty to forty feet high. Cherchen is an oasis upon this river, containing about 3000 people, who carefully cultivate some three to four thousand acres. Near by are the ruins of two ancient cities. Remains of buildings, clay cups, glass, burnt bricks, slag, beads, copper utensils, even gold and copper coins, ingots of silver and precious stones are found, as also coffins, the bodies in which are often well preserved through the excessive dryness of the climate. Nia and Kiria are the first in a series of oases which extends through Khotan and Yarkand to Kashgar, and then along the southern foot of the Tian-Shan.

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

Prejevalsky reports discontent at Chinese rule among the Mohammedan natives, and asserts that they long for a change of masters.

Asiatic News.—The Russians have commenced the Trans-Caspian railroad. It is opened nearly, if not quite, as far as Askabad, and is graded to Dushak, 150 kilometers farther. From this point, one branch will lead to Sarakhs, where it will connect with the English road from Quetta, through Afghanistan. The other branch will run north-east, crossing the Amu Daria and running through Bokhara to Samarcand. Merv, Samarcand and Bokhara are already connected by telegraph with St. Petersburg. ——The population of British Burmah in 1883 was 3,736,771. ——Mr. Needham and Capt. Molesworth have recently followed the Brahmaputra the whole way from Sadiya to Rima and state authoritatively that a river corresponding in size to the Sanpo falls into it, and that therefore the identity of the Sanpo with the Dijong may be considered as finally settled.——The Marshall archipelago, now under German protection, includes thirty lagoon islands, none of which rise ten feet above the sea. Coco-palms, pandanus and breadfruit form the vegetation, and a small lizard is the only native quadruped. The group consists of two chains, the eastern, or Ratack, and the western, or Ralick. In the latter series is situated the largest island of the group, Jaluit, which has an area of about thirty-five square miles, and contains a good harbor.——A recent eruption in the neighborhood of Tonga has upheaved an island of nine square miles in extent in the space of four days. A party who visited the island in a schooner on October 17th, report that a submarine volcano upon the shore of the new island was throwing up an enormous quantity of steam and water. The island has already been named Takaogo, is sixteen to twenty miles north-west of Henga-Hapai, and rises 200 to 300 feet above the ocean surface.

Africa.—*British and German Protectorates.*—The Kalahari desert and the whole of Berlmana land were, on March 23, 1885, proclaimed to be under British protectorate. This protectorate includes all the territory lying east of 20° E. long., west of the Transvaal and Orange river republics, and south of 22° S. lat. The Boer republics of Goshon and Stellaland are embraced within this area.

The British protectorate of the Niger districts comprises the territories between Lagos and the right or western river-bank of the mouth of the Rio del Rey. It also includes the territories on both banks of the Niger as far as its confluence with the Benue at Lokoja, as well as the territories on both banks of the Benue, up to and including Ibi. Ibi is about 230 miles above the confluence of the Niger and Benue. Great Britain has agreed not to acquire territory, accept protectorates, or interfere with the extension of German influence to the eastward of a line following the right river bank of the Rio del Rey to its source, then striking direct to the left river bank of the Old Calabar or Cross river, and terminating after crossing that river at the Rapids in about 9° 8′ E. long. Germany has agreed not to interfere to the west of the above line. Both powers relinquish any existing protectorates within the limits of the territories assigned to each, except that Victoria, Ambas bay, will still continue a British colony. Germany also engages to refrain from making acquisitions of territory or establishing protectorates on the coast between Natal and Delagoa bay.

African News.—M. de Brazza reached Paris November 12, 1885. He states that the whites and natives of the territories belonging to France are on the best of terms. Natives are being recruited to form an army.——The government of the Congo State has commissioned several geographers to execute maps of the entire State. Lieut. Massari is surveying the right bank of the Congo between the Alenia and Mobangi.——M. L. de Guiral is engaged in exploring the San Benito, about seventy miles north of the Gabon. The river is navigable only for twenty-two miles. There is a small lake eighty-seven miles from the coast, and three tributaries enter the San Benito above the first falls.

EUROPE.—*European News.*—A search for the true source of the Danube seems strange at this late date; yet M. de Wogan has found that it does not rise, as has been stated, in the gardens of the Prince of Fürstenburg, at Donaueschingen. It is formed by the union of two small streams, the Brig or Brigach and the Breg or Bregach. The first rises at Saint Georges, north of the Tryberg mountain and about a mile from the source of the Neckar, while the second rises at St. Martin, west of Tryberg and twenty miles from Donaueschingen, where the two streams unite.——The range called Umb-dek, in the Kolu peninsula, about a thousand meters high, is the highest land in European Russia north of the Caucasus.——Bosnia and Herzegovina have increased fifteen per cent in population between 1879 and 1885. The population at the latter date was 1,336,101.

GEOLOGY AND PALÆONTOLOGY.

THE VERTEBRATE FAUNA OF THE TICHOLEPTUS BEDS.—In the Report of the U. S. Geological Survey of the Terrs., Vol. III, p. 18 (1885), I have given some of the characters of this horizon and its fauna. It is intermediate in all respects between the Middle and Upper Miocene formations of the West, as represented by the John Day and Loup Fork beds. It was first explored in the valley of Deep river, Montana, by my assistant, J. C. Isaac, and afterwards by J. L. Wortman on the Cottonwood creek, Oregon. At the latter locality it is seen to rest on the John Day beds, as stated by Mr. Wortman, and as indicated by the collections made by him. The following species were found at the latter locality:

Protohippus, ? sp.	*Dicotyles condoni* Marsh.
Hippotherium seversum Cope.	*Protolabis transmontanus* Cope.
" *sinclairi* Wortman.	*Merycochœrus obliquidens* Cope.
" *occidentale* Leidy.	*Blastomeryx borealis* Cope.
Anchitherium ultimum Cope.	

Considerable interest attaches to the discovery of an Anchitherium and of a Merycochœrus at this locality, as these genera ally the epoch to the John Day period, while Hippotherium, Dicotyles and Protolabis are Loup Fork genera.

The *Anchitherium ultimum* is represented in my collection by a nearly complete superior dentition, with palate and sides of skull to the middle of the orbits, and top of skull to above the infraorbital foramen. The size is less than that of the *A. præstans* Cope and *A. equiceps* Cope (? *A. anceps* Marsh) of the John Day bed, and the dental series has the same length as that of the *A. longicriste* Cope, also of the John Day.

It is in the cranial characters that this species displays the greatest differences from the John Day species. In the first place there is a profound and large preorbital fossa, separated from the orbit by a vertical bar. The preorbital fossa in the John Day species is shallow, and not abruptly defined. In the next place the anterior border of the orbit is above the anterior border of the last molar tooth. In this it agrees only with the large *A. præstans*; in the *A. equiceps* and *A. longicriste* the anterior border of the orbit is above the anterior part of the second superior molar. Thirdly, the infraorbital foramen is above the middle of the fourth premolar; it is over the posterior part of the third in the three John Day species. Finally, the nareal notch marks the anterior two-fifths of the diastema; it extends much further back in the John Day species, marking either the front or middle of the first premolar. The palate extends about as far anteriorly as in *A. præstans*, viz., to opposite the posterior border of the first true premolar.

The *Merycochœrus obliquidens* is smaller than any known species of Merycochœrus, about equaling the larger individuals of *Oreodon culbertsoni*. The molar teeth are, however, relatively larger than in that animal, and in the species of Eucrotaphus, and the anterior premolars and incisors smaller and more crowded. The last two premolars are in line, but the second premolar is set obliquely in the jaw so as to overlap the first premolar by the whole of its anterior root, and the third premolar by half of its posterior root. The anterior root is interior, the posterior exterior. The first premolar has a robust root with round section. The crown is but little expanded at the posterior base; anterior part and apex lost. The alveolus of the canine diverges somewhat outward. The symphyseal suture is short and rather deep. Its posterior edge is below the posterior quarter of the third premolar.

In the *Merychyus pariogonus* Cope of the Deep River Ticholeptus bed, the posterior part of the ramus is more expanded, and is perfectly rounded, while the other dimensions are considerably smaller.

Full descriptions of these species are given in a paper read before the American Philosophical Society, Feb. 19, 1886.

The species of the Ticholeptus beds of Montana are the following:

Mastodon proavus Cope.	*Cyclopidius emydinus* Cope.
Protohippus sejunctus Cope.	*Pithecistes brevifacies*[1] Cope.
Merycochærus montanus Cope.	" *decedens* Cope.
Merychyus zygomaticus Cope.	" *heterodon* Cope.
" *pariogonus* Cope.	*Procamelus vel Protolabis*, sp.
Cyclopidius simus Cope.	*Blastomeryx borealis* Cope.

The only species common to the two lists is the *Blastomeryx borealis*, a fact which indicates some important difference in the horizons, either topographical or epochal. The Oregon specimens consist of teeth only, from both jaws, which are identical with those of the three crania known from Deep river. This animal is one of the deer-antelope, with persistent horns and deer-like dentition. Its horns are long and stout, and have a wide basal expansion above the posterior part of each orbit. It is about as large as the black-tailed deer.

The Ticholeptus horizon is interesting as that in which the genus Mastodon makes its first appearance in America. It is now shown to be the last which contains the genus Anchitherium.—*E. D. Cope.*

SCUDDER'S FOSSIL INSECTS.—Mr. S. H. Scudder has contributed to Zittel's Handbuch der Palæontologie, now being issued in parts at Munich and Leipzig, a very valuable résumé of our knowledge of fossil tracheate Arthropoda, with abundant and excellent illustrations in the text. In accordance with the treatment in other parts of the work, the classes are first defined, also the orders and families, while the genera are less briefly diagnosed and the leading species mentioned, or where the species are numerous the number of known fossil ones given. In the myriopods American forms predominate, while among the Arachnida more European species are known. The tables of geologi-

[1] The absence of caries in the teeth of extinct Mammalia is well known. The type specimen of the *Pithecistes brevifacies*, however, displays a carious excavation on the external side of one of its inferior molars. This feature adds to those which indicate the degeneracy and approaching extinction of this type, as I have remarked in my synopsis of the Oreodontidæ, Proceedings American Philosophical Society, 1884, 557.

cal distribution of both myriopods, Arachnida and insects are of much value.

The class of insects begin with the Palæodictyoptera, which embrace all the Palæozoic insects, and is regarded as equal in rank with the Heterometabola (Orthoptera, Neuroptera, Hemiptera and Coleoptera).

The principal forms are well illustrated. As a provisional arrangement the Palæodictyoptera, as thus limited, may serve a temporary purpose, but the wonderful discoveries of Brongniart at Commentry, in France, seems to us to forbid the adoption of such a division, and to favor Brongniart's view that many of them, except Eugereon and possibly others, are simply Palæozoic genera of existing orders of insects, *i. e.*, representatives of distinct and extinct families, rather than of lost orders. But Brongniart's discoveries were not placed in the hands of the scientific public until after the work before us was mostly in print. Some of the divisions, as the Coleopteroidea, for the unknown manufacturer of the holes attributed to Hylesinus by Brongniart, seems unnecessary. Why the Thysanura should be placed as a "family" of the suborder Pseudoneuroptera is inexplicable to us, now that their structure is so well known.

But however one may differ from the author in matters of classification, he can not fail to note the care, labor and learning which has been bestowed upon this excellent and most useful summary.

Oscar Schmidt on the Origin of the Domestic Dog.[1]—We must now refer to the question of the origin of the domestic dog. That the whole line of foxes has nothing to do with the dog has long been an established fact. On the other hand Darwin endeavored to prove that various wild tribes of men in different parts of the globe tamed native wolf-like animals, and that the crossings of these species and breeding of various kinds produced the domestic dog of our day. This opinion of Darwin has been somewhat modified by L. H. Jeitteles, a careful authority on the domestic animals. According to him the wolf (*Canis lupus*) has no connection with the European and west-oriental races of dogs, the connection being mainly through the *jackal* and the *Indian wolf* (*Canis pallipes*). The races partly lead back into prehistoric times. Closest to the jackals we have the so-called *turf-dog*, known from the turf deposits of the lake-dwellings, and which is probably the ancestor of our Pomeranian dogs. Allied to it we have the terriers and turnspits. From *Canis pallipes* is descended the so-called *bronze-dog*, which most probably came to Europe with human immigrants from Asia, and with it the sheep dog of Central Europe, the larger sporting dog, the poodle, cur-dog and bull-dog. The ancestor of a third group may perhaps be found in the large jackal (*Canis lupaster*) of North Africa, to which we

[1] The Mammalia in their relation to primeval times. New York, D. Appleton & Co., 1886.

should also have to refer the ancient *Egyptian-dog*, the Oriental *street-dog* and the *wild dog of Africa*.

This does not as yet settle the question as to which fossil forms may be concealed among the numerous races of the domestic dog. Various conjectures have been made, none of which, however, are based upon any special reasons. According to Blainville's opinion, a diluvial species of a gentle and sociable nature—no longer existing in a wild state—must have been the primeval form of the domestic dog; but after what has been said above, this general way of settling the question must be regarded as one that no longer holds good. Woldrich's views show a greater amount of probability, and have lately been taken up again; he maintains that our domestic races are descended from several wild forms of the Canidæ of the Diluvium, and herein he agrees with what Darwin and Huxley have stated regarding the relation between the domestic dog and the living jackals and wolves.

It may with certainty be maintained that the direct ancestors of the European wolf are to be found in the Diluvial deposits. Formerly a huge animal of the wolf species was distinguished as the *cave-wolf*, without there being any distinct character to separate the two forms. A third form of wolf (*Canis suessii*, from the löss near Vienna) is described as a slim but powerful animal, strong enough even to pursue and overpower the larger species of plant-eaters. It is, in fact, one of the eight species of wolves which can be distinguished during the Diluvial early ages of man. And in addition to these there are about five kinds of foxes.

In now returning to the living Canidæ, several species demand our attention, one of which is described as *Icticyon venaticus*, a native of Brazil, the other under the generic name Cyon, inhabiting the countries to the north and north-east of the Altain mountains. These dogs do not possess the third molar in the lower jaw, and the molar tooth in the upper jaw is so small that a reduction appears to be imminent there as well. It is in the natural course of things that one or both of the first premolars, or the last molar, should become useless and forced to disappear by the neighboring teeth being specially taken into requisition, although in most cases we do not know the immediate reason of this.[1] The other circumstances of the structure of this group do not lead us to expect anything special from this concentration of the dentition. In former times, however, as we shall soon see, a most varied de-

[1] Any of our readers who can examine the head of a dachshund may convince themselves of the fact that the first premolar above and below can scarcely be of any use to the animal; it is a little stump which does not come in contact with the opposite row of teeth, and is frequently wanting altogether. If the dachshund is not forcibly suppressed as a species, its dentition will one day inevitably be reduced by one premolar.

velopment of new genera of beasts of prey began with dog-like animals.

Much more interesting for the purpose of our investigation here is the *Otocyon lalandii*, the spoon-dog of South Africa, so called from the peculiar formation of the skull. Its habits show an approximation to the foxes, yet as regards dentition it does not show this affinity, inasmuch as it possesses $\frac{4}{4}:\frac{4}{4}$ molars, and also shows the most remarkable differences in the relative size of the single teeth. As already said, the spoon-dog is, in many ways and as regards dentition, shaped after the fashion of the dog type, and can thus scarcely be dragged out of this connection, and we are compelled to look upon it as a still existing primary form of dog. The whole palæontology of the vertebrates shows that the many-toothedness of mammals is an inheritance from their lower ancestors, and that any increase of the teeth within a class has probably never taken place.

As our dogs, with their $\frac{2}{3}:\frac{2}{3}$ molars, have no doubt been descended from fuller-toothed animals, Otocyon must be regarded as the still-living representative of the early type of dog, which in other characteristics shows more affinity to the fox genus. But as there also exist species of the group *Canis azaræ* with very small frontal depressions, it is, as Huxley says, very difficult not to imagine that these too must be traced to ancestors of the Otocyon type. From this species, therefore, we should have to derive the two lines which diverge into the fox on the one hand, and the wolf on the other. We are supported in this view by the observation that the South American *Canis cancrivorus* often possesses the fourth molar, and thus shows itself to be another remnant of the primary form. A fourth supernumerary molar of this kind is not a monstrosity or pathological phenomenon, but an atavism or reversion of the same sort as the so-called wolf's tooth in horses, which was explained as a premolar which existed in the primary genus Anchitherium.

Hence the key to the derivation of all the dog tribe is to be found in their relation to the spoon-dog.

Geological News.—*Silurian.*—S. G. Williams, in a communication to the February number of the *American Journal of Science*, states that rocks of the Lower Helderberg period, including all above the water-lime group, are represented in New York, as far west as Cayuga lake, by limestones not less than sixty-five feet thick, containing an unmistakable Lower Helderberg fauna. Though fossils are rare in Cayuga county, fifteen species have been found, two or three of which are as yet undescribed, while the others all belong to Lower Helderberg species. Among them are two species of Strophodonta, *Rhynchonella semiplicata*, Stromatopora (most abundant of all), a Favosites and a Zaphrentis.

Triassic.—The geological age of the yellow sandstones lying north of the city of Elgin (Scotland) has been much debated, stratigraphists having maintained that they belonged to the Devonian (or rather Old Red sandstone), while palæontological evidence is in favor of their Triassic age. The Lacertilia are represented by Telerpeton, Hyperodapedon and an undescribed form, Crocodilia by Stagonolepis, and Dicynodontia by the type genus. Dr. Judd and Dr. Gordon have now procured good evidence that this reptiliferous sandstone passes down into a bed of conglomerate which rests unconformably upon the strata of the Upper Old Red sandstone. The conclusion is that during the vast periods of the Carboniferous and Permian, the Upper Old Red sandstone of the Elgin area was upheaved and denuded, and the Upper Trias beds deposited unconformably upon their eroded surface.

Jurassic and Cretaceous.—MM. Bertrand and Kilian, who have studied the Jurassic and Cretaceous strata of Andalusia, report that their composition is very like that of the same beds in the Alps. There are also many analogies between them and the corresponding beds of Sicily and of the Apennines, while the upper beds resemble those met with in the Balearic islands. The brachiopod beds of the Middle Lias and the ammonite beds of the Toarciari are met with alike in Sicily, the Apennines and parts of the Alps.

Quaternary and Recent.—M. Choper reports the existence of glacial beds in the French colony of Assinie, upon the coast of Guinea.——A letter from J. W. Dawson to *Nature* contains some interesting notes upon the causes of the purity of Nile mud. This mud, brought down chiefly by the Atbara and the Blue Nile from a country of siliceous and crystalline rocks, is, like that of the St. Lawrence, almost free from salt. It is also deficient in kaolin, (1) because the current of the river is sufficiently strong to wash into the sea all the more finely comminuted argillaceous matter; (2) because the older gneisses and schists do not kaolinize like Cornish granites, but crumble into sand, much of the feldspar remaining in a perfect state.——Professor Heim, known as one of the best authorities on glaciers, states that the motion of a glacier is, to a preponderating extent, the result of gravity. He enumerates partial internal liquefaction, caused by pressure; plasticity of the ice as it approaches the melting-point; ruptures and slight displacements, alternating with partial regelation and sliding on its bed, as sources of glacier motion. Glaciers merely smooth and very slightly wear away the previously existing rough surfaces, while streams and sub-aërial weathering have given valleys their form. The glacier is more of a carrier and rubbish-remover than of a delver and ploughman.

MINERALOGY AND PETROGRAPHY.[1]

HUSSAK'S "DETERMINATION OF ROCK-FORMING MINERALS."—The appearance in English of any book which treats of the methods of the new geology, is a subject for congratulation on the part of those who believe that the use of the microscope will reveal much of interest in the development of the earliest history of the earth's life. The importance of microscopical petrography is shown in the fact that the leading geologists all over the world are devoting much of their time to the study of the mineralogical characteristics of the rocks which form the solid crust of our globe and to the changes which these rocks undergo under various conditions. It is a lamentable fact that, though so much is now being done in this field, but few good English text-books exist. The only works relating to this subject which have appeared in English are Zirkel's Microscopical Petrography[2] and Rutley's Study of Rocks.[3] Both of these treat more particularly of the classification of rocks and presuppose a knowledge of the elementary principles, by means of which their mineral constituents are recognized. It is with pleasure that we now welcome a third volume, which treats of the optical properties of minerals and the methods which are made use of in their detection. Dr. E. G. Smith, of Beloit, Wisconsin, has very recently translated[4] Dr. Hussak's little book, noticed in the April number of the NATURALIST. Unfortunately, the first part of the translation, which treats of the methods of investigation, the optical properties, etc., of minerals, is marred by clumsy constructions, due to the literalness with which the original text has been followed. Most of the errors which the German petrographers have pointed out have been allowed to remain uncorrected. In many cases the choice of expressions for words and phrases occurring in the original are misleading. "The entering face of the light" is used for "Eintrittsfläche" (p. 18), "shell-formed" for "Schalenförmig" (p. 90), and "springlings" for "Einsprenglinge" (p. 85). A few words are mistranslated, and one (Kolben) is not translated at all. Certain sections of orthorhombic minerals are spoken of as not extinguishing "for the most part according to their axial figures" (Figurenaxen) (p. 23). More serious than these are the errors which arise from the confusion of the optical axes with the axes of elasticity; of biaxial minerals with those which are doubly refracting; and finally of isotropic substances with those exhibiting parallel extinction. The second part is taken up with a tabular arrangement of the principal minerals which enter into the composition of

[1] Edited by W. S. BAYLEY, Johns Hopkins University, Baltimore, Md.

[2] Washington, 1876.

[3] London, 1879.

[4] New York: John Wiley & Sons, 1886.

rocks. These are placed vertically in groups, according as their cross-sections are isotropic, or show parallel or inclined extinction. These groups are again subdivided in accordance with the crystallographic systems. Opposite the name of each mineral are placed its chemical composition, specific gravity, characteristic cleavages, the ordinary forms of its cross-sections, its twinning laws, the character and strength of its double refraction, its colors under crossed nicols, its natural color and pleochroism, its structure, the minerals with which it is generally associated, its characteristic inclusions and decomposition products, and those peculiarities which distinguish it from other minerals of the same general appearance. In this part an immense amount of material is so arranged that with very little trouble the student can turn to the mineral whose properties he wishes to study, and find in a few brief sentences the characteristics by which it can be distinguished from all others. This part will prove of considerable use to all who are beginning the study of petrography, and whom such manuals as that of Rosenbusch would tend only to confuse and discourage. A great service has been rendered to all those to whom the material in Dr. Hussak's book is inaccessible on account of the language in which it is written, and the translator deserves the thanks of all those interested in petrography for having placed within the reach of American students the elements of a branch of geology which is just beginning to be appreciated on this side of the Atlantic, as affording a key for the solution of many questions which have heretofore been considered as beyond the power of penetration.

PETROGRAPHICAL NEWS.—The relations of the bastite serpentine to the troktolite in the Belhelvie parish, in Aberdeenshire, are studied by Bonney, and the results of his investigations published in the *Geological Magazine*.[1] The serpentine is derived from an olivine-enstatite rock. The troktolite is a moderately coarse-grained mixture of purplish-gray or whitish feldspar and dull dark green serpentine. At the junction of these two rocks, it was found that every grain of olivine was surrounded by a reactionary rim. The sequence of the two rocks in respect to age is not satisfactorily decided. In the same paper, the "Black Dog" rock, first mentioned by Heddle,[2] as a mass of rock about four yards long and broad, which projects from the sand on the shore, is described as containing fibrolite, iolite, quartz and mica. It bears a very close resemblance to some of the cordierite gneisses of Bavaria.——Küch describes[3] a quartz-pyroxene-andesite from the Cumbal in the Andes, in which the pyroxene constituent is principally hypersthene, and remarks that this mineral is a much

[1] October, 1885, p. 439.

[2] Mineralogical Magazine, v, p. 1.

[3] Neues Jahrb. für Min., etc., 1886, 1, p. 35.

more frequent constituent of the andesites of this region than has hitherto been supposed.——Quite an addition to our knowledge of the metamorphoric rocks has recently been made in the articles of Von Miklucho-Maclay[1] and Joseph Götz.[2] The former treats of the schists found on the River Witim, in East Siberia. These consist of altered gneisses, brown-spar phyllite, in which rhombohedra of brown spar are found enclosing all the other minerals, and even in some cases forming complete pseudomorphs of quartz, and brown-spar phyllite gneiss, which differs from the brown-spar phyllite in containing complete pseudomorphs of plagioclase after brown spar, and also in the enlargement of its quartz by the deposition of new quartz substance. Götz reports the results of his investigations on the rocks occurring in the neighborhood of the gold fields of Marabastad in Northern Transvaal. These he divides into gneiss, amphibole rocks, chlorite schists, phyllites, ottrelite and andalusite schists, quartzites, serpentine and proterobase. After a very careful study of the structure and mineralogical composition of all these rocks, he concludes that pressure is the cause of the schistosity of the schistose kinds, and that to this agency is due also the formation of the ottrelite and andalusite, which took place contemporaneously with the assumption of the schistosity. Thus much additional information is added to our knowledge of that sort of regional metamorphism, called by Lossen[3] dislocation metamorphism, to which so much attention is now being directed by the leading German petrographers.

Mineralogical News.—In a late number of the Neues Jahrbuch,[4] Max Bauer publishes the continuation of his studies in mineralogy. In this paper he describes pseudomorphs of calcite after aragonite from Klein-Sachsenheim, in Württemberg. In all instances of this kind heretofore described the rhombic substance of the aragonite was supposed to have undergone a molecular rearrangement and thus to have passed over into rhombohedral calcite. A study of the Klein-Sachsenheimer crystals and the mode of their occurrence shows, however, that in some cases at least, a solution and deposition takes place. These crystals are found in a drusy dolomite, which originally contained in it lens-shaped masses of gypsum. This gypsum has been removed by water, and it was from this solution that the aragonite was deposited on the sides of the hollows left.[5] At the same time, there was a deposition of brown spar, which covered the

[1] Ib., 1885, II, p. 145.

[2] Ib., Beil., Bd. IV, p. 110.

[3] Zeits. d. deutsch. geol. Gesellschaft, XXI, p. 324.

[4] Band I, 1886, p. 62.

[5] From very dilute solutions or from those containing small amounts of gypsum, calcium carbonate is deposited as aragonite, while from concentrated solutions or those containing no foreign matter it is deposited as calcite.

little crystals of aragonite and protected them from the dissolving action of fresh supplies of water. Wherever an imperfection in the covering allowed water to gain access to the aragonite substance, a concentrated solution of this was formed and the salt was redeposited as calcite. Its external form, of course, was occasioned by the shell of brown spar, which remained undissolved. In nearly every case studied, an internal kernel of aragonite was surrounded by an external covering of calcite, showing that the change took place from without. The author thinks that many other cases of paramorphism may be explained by supposing a solution and redeposition of the material in the same way as that described.——Davreuxite, hydrous anthophyllite and hydrotephroïte have recently been investigated by Lacroix.[1] The first he describes as having all the optical properties of a mica. It is biaxial, with a negative bisectrix. It occurs in little plates, mixed with quartz grains in the quartziferous veins in the schists at Ottré. Hydrous anthophyllite (from Glen Urquhart, Scotland) is not a homogeneous substance, but is composed of fibers of actinolite, cemented together by a substance belonging to the chlorite group. Hydrotephroïte is a mixture in various proportions of at least three different substances. That which occurs in greatest quantity is colorless and biaxial and is probably tephroïte. The other substances are serpentine, chlorite and various manganese minerals. The hydrotephroïte is probably an altered tephroïte or some other manganese silicate.——Beautiful rhombohedral crystals of calcite are described by R. H. Solly,[2] from the Tankerville mine, Shropshire, Eng. They contain only the rhombohedral and scalenohedral faces, with the former predominating. The scalenohedral faces are bright and are covered with little quartz crystals, while the rhombohedral faces contain no quartzes, but are dull and corroded.——Until very recently our knowledge regarding the blue "sulphato-chloride of copper," to which Dana in 1850 gave the name connellite, has been confined to the results of the investigations of Maskelyne[3] and Bertrand.[4] Lately, however, in consequence of the discovery of new material, the crystallography of the mineral has been thoroughly worked up. Connellite occurs in copper veins traversing clay slate and granite in the Camborne district, situated at the west end of the granite boss in which most of the productive tin mines in England occur. The mineral is not found massive, but only in aggregates of minute crystals, the largest measuring from two to four millimeters in length. In crystallization they are hexagonal, containing only the simple forms P, ∞ P2 and ∞ P, in addition to those observed by Maskelyne.——

[1] Comptes Rendus, CII, 1886, p. 273.
[2] Mineralogical Magazine, VI, May, 1885, p. 120.
[3] Philosophical Magazine, January, 1863.
[4] Bulletin de la Soc. Min. de France, 1881, IV.

Guejarite, hitherto known only from Spain, is mentioned by F. Sandberger[1] as occurring at Machacamara, in Bolivia, in radial aggregates in white quartz, associated with barite.——G. F. Kunz announces in a paper in the *American Journal of Science*[2] that the meteorite described by him at the last meeting of the American Association as the Charleston, W. Va., meteorite, fell on Jenney's creek, Wayne county, W. Va., and not, as before stated, at Charleston. It is described as a meteoric iron, made up of crystalline blocks of plessite and kamacite, and belongs to the "grobe Lamellen" of Brezina. An analysis yielded: $Fe = 91.56$, $P = 0.13$, Ni and Co (by difference) $= 8.31$.——The minerals of the region around Stempel, near Marburg, and those of the Erzgebirge have been pretty thoroughly investigated by Stadtländer,[3] of Lüneberg, and Schalch,[4] of Leipzig. The former thinks that the optical anomalies of analcite must be the result of secondary conditions which acted after the crystal had been formed.[5] He finds also twins of Natrolite in which the twinning axis is normal to ∞P and the composition face is the base.——In a little book entitled Die Chemische Natur der Mineralien,[6] Rammelsberg attempts a systematic arrangement of all the minerals, the analyses of which show them to have a constant composition.

Miscellaneous.—Improved methods for the detection of small quantities of silver, chlorine, selenium, sulphur, arsenic, antimony, barium, strontium, lithium and sodium under the microscope, are described by Streng in the last number of the Neues Jahrbuch.[7] The antimony is transformed into antimony chloride; a little of this is evaporated to dryness in an object glass, and the residue moistened with a drop of water holding barium tartrate in suspension and a little barium chloride in solution. On evaporation, little rhombic tables of barium antimony tartrate are found around the edges of the drop. A closer examination of these shows them to possess a monoclinic symmetry, with the forms $0P$, P and $\frac{1}{3} P\infty$ best developed. A practical use of these methods is made in an examination of the composition of rittingerite and pyrostilpnite. The latter is found to be $Ag_3 Sb S_3$, the former $Ag_3 As S_3$ or $Ag_3 As (S. Se)_3$.

[1] Neues Jahrb. für Min., etc., 1886, I, p. 89.

[2] February, 1886, p. 145.

[3] Neues Jahrb. für Min., etc., 1885, II, p. 97.

[4] Ib., Beil., Bd. IV, p. 178.

[5] Cf. American Naturalist, 1885. March, p. 296; September, p. 886.

[6] Carl Habel, Berlin, 1886.

[7] 1886, I, p. 49.

BOTANY.[1]

Branching of Osmunda claytoniana.—In those ferns in which the vascular system of the stem consists of a ring of separate bundles, branches and leaves usually arise by an increase by division of the bundles, until a portion is deflected with surrounding tissue to the lateral member. The method in the Osmundas is not so simple. In Fig. 1, *A* shows a cauline bundle, *b b'*, in which an outer portion is being separated to form the bundle of a stipe, as at *C*. Two lateral portions, between this and what remains, are deflected to roots at each side of the base of the stipe which originate at the same time, as at *r r'*. The divisions which remain in the stem unite with similarly divided parts of adjoining

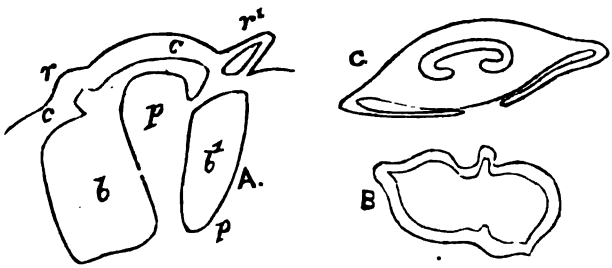


Fig. 1.—*A*, segment of cross-section of stem; *b b'*, a bundle dividing into a central outer portion, which enters a stipe, two lateral portions which enter the beginnings of roots *r r*, and two larger portions which remain in the stem; *p*, pit; *c*, cortex; *B*, section of stem below a fork, showing preparatory constriction; *C*, section of stipe, about an inch from the base, showing single large bundle. *A*, reduced from camera sketch, magnified ten, *B* and *C* about two diameters.

bundles, so that the number in the stem remains the same. From the condensed character of the stem, the vascular system at any section appears as a series of incomplete and variously united bundles.—*A. A. Crozier, Grand Rapids, Mich., Jan. 27, 1886.*

Movements of Desmids.—Herr G. Klebs describes (*Biologisches Centralblatt*) four different kinds of movements in the Desmidieæ, viz: 1. A forward motion on the surface, one end of the cell touching the bottom, while the other end is more or less elevated, and oscillates backwards and forwards during the movement. This is especially well seen in *Closterium acerosum*. 2. An elevation in a vertical direction from the substratum; the free end making wide circular movements (*C. didymotocum*). 3. A similar motion, followed by a sinking of the free end and an elevation of the end previously depressed, and so on alternately (*C. moniliforme*). 4. An oblique elevation, so that both ends touch the bottom; lateral movements in this position; then an elevation and circular motion of one end and a sinking again to an oblique or horizontal position (*C. dianæ* and *archerianum*). These move-

[1] Edited by Professor Charles E. Bessey, Lincoln, Nebraska.

ments are none of them peculiar to particular species; several of them are often combined in one. A free swimming on the surface, like that of diatoms, was never observed.

The first two of these movements depend on the formation, during the motion, of a filament of mucilage, by which the desmid is attached to the bottom; the gradual lengthening of this filament, by the formation of fresh mucilage, causes the desmid to rise. The filament is best detected by a weak solution of methyl-violet or fuchsin, which does not kill the desmid. Cyanin also answers, but not so well. Other pigments do not stain it. Many species of Euastrum, Cosmarium, Staurastrum and Pleurotænium exhibit the same phenomenon. The greatest length of filament observed was $3^{mm.}$; the most rapid motion, in *Closterium acerosum*, 112μ in 30 sec.; many species are quite motionless. Light exercises an influence on the direction of the movement similar to that of zoöspores, but not on its rapidity. The elevation and depression appear to be independent of the direction of gravitation.

The author considers the cause of the motion to be the exudation of mucilage, which does not take place simultaneously and uniformly over the whole surface of the desmid. This formation of mucilage is not the result of disintegration of the cell-wall itself; it proceeds directly from the cytoplasm and passes through the cell-wall without the latter undergoing any change. Many species are completely surrounded by a gelatinous envelope, while others are comparatively free.—*A. W. Bennett, London.*

Pleomorphism of Algæ.—Dr. A. Hanszig publishes in the *Botanisches Centralblatt* an elaborate paper which has for its object to prove that a large number of algæ hitherto referred to the families Schizophyceæ or Cyanophyceæ, Chroococcaceæ, Oscillariaceæ, Nostocaceæ, Scytonemaceæ, Confervaceæ, Chætophoraceæ, Siphonocladaceæ and Ulvaceæ are but stages in the evolution of single forms. He describes the mode in which these various forms of algæ may develop one out of another, and he regards also the Schizophyceæ and Schizomycetes as connected together by insensible gradations. Thus we may have one and the same alga occurring in its mature form, and in its Stigonema, Leptothrix, unicellular, Nostoc, Ulothrix, and a variety of other forms. Euglena he regards also as genetically connected with the Phycochromaceæ and Oscillariaceæ. Dr. Hanszig refers to a new analogy between the Schizomycetes and Schizophyceæ by the discovery of a motile organism which he names *Chroomonas nordstedtii*, and which he regards as the swarm-cell condition of a phycochromaceous alga, probably an Oscillaria.—*A. W. Bennett.*

Tree Growth on the Plains.—From a recent paper on "Tree Planting on the Plains," by Robert W. Furnas, we extract the following statistics of the growth of trees, as shown by actual measurement of trees of known ages. The measurements were made at the uniform height of two feet above the ground.

Common Name.	*Scientific Name.*	*Years Old.*	*Circumference. (Inches.)*
White Elm	Ulmus americana	15	24¾
Red Elm	Ulmus fulva	24	36
Osage Orange	Maclura aurantiaca	25	26¼
Soft Maple	Acer dasycarpum	18	54¾
" "	" "	18	69¼
Box Elder	Negundo aceroides	14	25¼
" "	" "	14	31⅛
Honey Locust	Gleditschia triacanthos	22	40¼
" "	" "	22	41½
Black Locust	Robinia pseud-acacia	24	60½
Kentucky Coffee tree	Gymnocladus canadensis	14	25½
Sycamore	Platanus occidentalis	16	43½
Black Walnut	Juglans nigra	22	48
" "	" "	22	50¼
White Walnut	Juglans cinerea	22	49¼
Shagbark Hickory	Carya alba	24	30
Chestnut	Castanea vesca, *var.* americana	14	24½
Burr Oak	Quercus macrocarpa	22	36⅛
White Oak	Quercus alba	22	29
White Ash	Fraxinus americana	22	32¼
Green Ash	Fraxinus viridis	22	30
Cottonwood	Populus monilifera	23	78¼
"	" "	23	93
White Pine	Pinus strobus	20	36¼
Scotch Pine	Pinus sylvestris	15	23
Austrian Pine	Pinus laricis, *var*	15	22½

Botanical News.—Late numbers of *Annales des Sciences Naturelles* contain papers on the following subjects, viz: The actual state of our knowledge of the function of chlorophylline, Researches upon the development of the sporogone of the Hepaticæ, Observations upon the Santalaceæ, Researches upon the comparative anatomy of the stem of the Dicotyledons, Researches upon the variation of the respiration with the development of plants, The respiratory function of vegetation.——The more important papers in the sixteenth volume, just closed, of Pringsheim's Jahrbücher für Wissenschaftliche Botanik are Schimper's Investigations upon chlorophyll bodies, Tschirch's Contributions to a knowledge of the mechanical tissue systems of plants, De Vries' Plasmolytic studies on the vacuole wall, Reiche's Upon the anatomical changes in the perianth-whorl which precede the development of the fruit. This volume contains twenty-eight plates.——An interesting paper on intramolecular respiration, by W. Pfeffer, is just received. It is in continuation of work done by Dr. W. P. Wilson, of Cambridge, Mass.——A white-seeded variety of the honey locust is described by Thomas Meehan in Proceedings of the Academy of Natural Sciences, Philadelphia, December 1. The tree bearing these anomalous seeds is of considerable age, and stands near Germantown, Pa.——A neatly printed Catalogue of the Phænogamous and vascular cryptogamous plants of Fitchburg [Mass.] and vicinity is worthy of note as being "the work of students of the Fitchburg high school." It is said to represent "about seven years of diligent research." It is a very creditable production, and indicates good work in the school.——The Fourth Annual Report of the Board of Control of the New York Agricultural Experiment Station, for the year 1885, appears with a most satisfactory promptness. Its contents show the continuation of the high class of work for which this station has been distinguished.——E. W. D. Holway, of Decorah, Iowa, has made out a set of genus labels of the fungi for use in herbaria. There are about 720 names, which represent, after deducting duplicates, from 500 to 600 different genera. The printing is done by H. N. Patterson, of Oquawka, Ills., which is a sufficient guarantee of the neatness of the typography.

ENTOMOLOGY.

On the Cinurous Thysanura and Symphyla of Mexico.—It was my good fortune during a short visit to Mexico in the spring of 1885, to discover the one insect which I scarcely hoped to find, so rare are the species and individuals in other parts of the world. This was *Japyx saussurii*, described and figured by Humbert in *Revue et Mag. de Zoölogie*, xx, 345, 1868. His descriptions and excellent figures were made from three specimens collected by M. Sumichrast at Santa Cruz, Moyoapam, near Orizaba. It was evidently hopeless to look for Japyx on the Mexican plateau in the dry season, if it lives there at all; though near Vienna *Japyx solifugus* occurs in dry, sandy places, where, in 1872, I had the rare pleasure of observing it under the kind guidance of Dr. Brauer. The Cinuran characteristic of the *tierra templada* is a species of Machilis, which was common under stones at Saltillo.

At Cordova, however, owing to the kindness of a Spanish gentleman, the owner of a coffee plantation, who allowed me the use of one of his laborers, an intelligent Indian, I found about a dozen specimens of *Japyx saussurii*, in the shaded damp coffee growth, which my Indian turned up with his hoe from the rich, black soil under fallen banana trunks and loose stones. They seemed to be comparatively common, and very active in their movements.

On comparing with it our northern *J. subterraneus* Pack., from Kentucky, our species is seen to differ decidedly from the Mexican in the much squarer head, which is broader in front; in the broader prothorax, and especially in the longer and narrower tenth abdominal segment. It also differs in the denticulations of the blades of the forceps (cercopoda), the largest tooth on the inside of the left blade being situated nearer the middle. Our species is also smaller. The number of joints to the antennæ in *J. subterraneus* are 32; in the Mexican species 40.

Associated with the Japyx and in equal abundance was a Scolopendrella, which I at first supposed to be a different and larger species, but which, after a careful microscopical examination, I cannot separate from *S. immaculata* Newport. It has the same general appearance; and the form of the antennæ and number of antennal joints are nearly the same; there being 40–42 joints in the Mexican, and 35–36 in a Kentucky individual. The number of scutes behind the head is the same (16), and their shape exactly the same. The anal cerci are slightly longer than in United States specimens, but the fine setæ are the same in size and arrangement. The specimens are pure white and larger (5^{mm}) than any I have yet seen from the United States.

Campodea mexicana, n. sp.—While *Scolopendrella immaculata* seems to be common to Europe, the United States, and Mexico, and *Campodea staphylinus* Westw., likewise common to Europe and the northern United States, we discovered at Cordova, in company with the foregoing Synaptera, a very distinct species of Campodea, which is apparently characteristic of the *tierra caliente* or warm zone of Mexico.

It is a large species, the body 4^{mm} or 7^{mm} including the caudal stylets, being but little smaller than *C. cookei* Pack., of Mammoth and adjoining caves, but with much shorter caudal appendages. The body is shorter, the three thoracic segments being shorter than in *C. cookei.* The antennæ are of the length of the body and 28-jointed; the terminal joint is intermediate in shape between *C. staphylinus* and *C. cookei*, being slenderer than in *C. staphylinus.* Dr. J. S. Kingsley has discovered a sense-organ at the end of the last antennal joint of *C. staphylinus;* that of *C. mexicana* is slightly smaller, rounded oval, but situated near the middle of the joint; while that of *C. cookei* is larger than in *C. staphylinus*, but as in that species situated at the end of the joint; the joint in all three species is rich in nerve-cells. The caudal appendages are rather short, and composed of 7–8 long joints. There are other interesting differences from *C. staphylinus*, which, however, could not be understood without figures, which we have prepared, but reserve for a future occasion.—*A. S. Packard.*

THE LOCUST IN SOUTHEASTERN RUSSIA.—The Agricultural Academy in Moscow, has each summer for two years sent Professor K. Lindeman to Southeastern Russia to study the locusts ravaging that region, and the results of his travels have been published in two large works, one (1883) on the locust in the Danubian Cossack region, and the other (1886) on the locust in the Kouban region. He writes to the editor of the *Entomologische Nachrichten* for Jan., 1886, that he has satisfied himself that the locust (*Acrydium migratorium*) is not peculiarly an inhabitant of the plains or steppes, but that preferably and originally the lower regions of the banks of rivers, where grow *Arundo donax*, Scirpus, etc., are its birthplace, from whence it flies out and visits the steppes. *Acrydium migratorium* is in his opinion purely a swamp insect. Its eggs retain their vitality even if the region in which they are laid has remained covered for months in the spring by the water of the river. The larvæ in their third stage are marked with red, because this color protects them in the swamp surroundings in which they live. A group of red locust larvæ, sitting on spears of grass, give the appearance of a group of rushes bearing red ears. The similarity is so great "that I myself sometimes at a distance could not distinguish whether the red spots in a swamp were a colony of locusts or a group of rushes."

Entomological News.—In a paper on Parnassius, a genus of butterflies, read by Mr. H. J. Elwes at the meeting of the Zoölogical Society of London, held Jan. 10, the author paid special attention to the development, functions, and structure of the horny pouch found in the females of this genus. He also described the habits, distribution and variations of twenty-three species which he recognized in the genus. The paper was supplemented by Professor Howe's remarks on his examination of the anatomy of *Parnassius apollo*, and by Mr. Thomson's notes on the habits of the insects as bred in the society's gardens in 1885.——Dr. Witlaczil in *Zoölogischer Anzeiger*, Jan. 18, reaffirms against H. Wedde that the Aphides and Coccidæ suck their food in the same manner as Lepidoptera and other insects.——In the same number O. Poletajewa gives the result of his studies in the structure and function of the heart of insects, to which we shall call attention more fully hereafter.——Mr. A. D. Michael has described before the Linnean Society of London (Nov. 19), the remarkable nymphal stage of an Oribatid (*Tegeocranus cepheiformis*), during which the mite carries on its back as concentric shields the dorsal portions of all its cast-skins.——In the European myriopod, Sphærotherium, there is a well defined stridulating apparatus on the male claspers, which produces a shrill note like that of the house-cricket. A true auditory organ exists in the antennary fossa beneath the eye. The tracheal system is unlike the majority of that of the Diplopoda, rather resembling that of Chilopods and insects, though differing in the branched spiral filament not taking origin directly from the stigmata themselves.——A number of new species of American myriopods are described by F. Meinert in the Proceedings of the American Philosophical Society.

ZOOLOGY.

Phosphorescence of Marine Animals.—The address in Section D, biology, of the British Association, was delivered by Professor W. C. McIntosh, M.D., of St. Andrews, who selected for his subject, the "Phosphorescence of marine animals." A phenomenon so striking as the emission of light by marine organisms could not fail to have attracted notice from very early times, both in the case of navigators and those who gave their attention in a more systematic manner to the study of nature. Accordingly, we find that the literature of the subject is both varied and extensive—so much so, indeed, that it is impossible on the present occasion to give more than a very brief outline of its leading features. Though it is in the warmer seas of the globe that phosphorescence is observed in its most remarkable forms—as, for instance, the sheets of white light caused by Noctiluca and the vividly luminous bars of Pyrosoma—yet it is a feature which the British zoölogist need not leave his native waters to see both in beauty and perfection. Many luminous animals occur between tide-marks, and even the stunted seaweeds near the line of high-water everywhere sparkle with a multitude of brilliant points. As a ship or boat passes through the calm surface of the sea in summer and autumn, the wavelets gleam with phosphorescent points, or are crested with phosphorescent points, or are crested with light; while the observer, leaning over the stern, can watch the long trail of luminous water behind the ship from the brightly sparkling and seething mass at the screw to the faint glow in the distance. On the southern and western shores, again, every stroke of the oar causes a luminous eddy, and some of the smaller forms are lifted by the blade and scintillate brightly as they roll into the water. The dredge and trawl likewise produce, both in the shallower and deeper parts of our seas, many luminous types of great interest and beauty. He glanced, in the first instance, at the various groups of marine animals which possess the property of phosphorescence, and continued; It is found that this feature is possessed by certain members of the Protozoa, and by the following groups of the Metazoa, viz., cœlenterates, echinoderms, worms, rotifers, crustaceans, molluscoids, mollusks and fishes. In foreign seas many brightly luminous specimens are met with. Thus Professor A. Agassiz describes *Mnemiopsis leidyi* as "exceedingly phosphorescent, and when passing through shoals of these Medusæ, varying in size from a pin's head to several inches in length, the whole water becomes so brilliantly luminous that an oar dipped in the water up to the handle can plainly be seen on dark nights by the light so produced; the seat of the phosphorence is confined to the locomotive rows; and so exceedingly sensitive are they that the slightest shock is sufficient to make them plainly visible by the light emitted from the eight phosphorescent ambulacra." The same author mentions that Lesueuria has a very peculiar bluish light of an exceedingly pale steel color, but very intense. Giglioli, again, found that the beautiful riband-like Cestus shone with a reddish-yellow light, but in Eucharis the latter was intensely blue. In the Chætopteridæ the phosphorescence is remarkably beautiful, bright flashes being emitted from the posterior feet. Marine phosphorescence has some of its most striking examples among the Tunicates. One of the best known instances is that of Pyrosoma, the light from which has been so graphically described by M. Péron, Professor Huxley, and other naturalists who have had an opportunity of observing it. It proceeds in each member of the compound organism from two small patches of cells at the base of each inhalent tube. Phosphorescence in living fishes appears to have been accurately observed within a comparatively recent date, though the luminosity of dead fishes has been known from very early times, and has been the subject of many interesting experiments, such as those of Robert Boyle on dead whitings, and Dr. Hulme on herrings. I do not mean to say that the literature of the so-called phosphorescent fishes is scanty, for it extends from the days of Aristotle and Pliny to modern times, but that the writers have had little reliable evidence in regard to living fishes to bring forward. Thus, of upwards of fifty fishes entered by Ehrenberg in his list it is hard to say that one is really luminous during life. In many cases it is probable that the supposed phosphorescence of large forms, such as swordfishes and sharks, has arisen from the presence of multitudes of minute phosphorescent animals in the water, just as the herring causes a gleam when it darts from the side of a ship. Professor Moseley, for instance, observed in the *Challenger* that when large fishes, porpoises, and penguins dashed through phosphorescent water it was brilliantly lit up, and their track marked by a trail of light. The same feature is observed in hooked fishes, and it is known that fishermen are doubtful of success when the sea is very phosphorescent, for the presence of the net in the water excites the luminosity and scares the herring. One of the most striking instances of phosphorescence in living fishes is that of the luminous shark (*Squalus fulgens*), found by Dr. Bennett. This is a small, dark-colored shark, which was captured on two or three occasions at the surface of the sea. It emitted without irritation a vivid greenish luminosity as it swam about at night, and it shone for some hours after death. The phosphorescence appears to be due to a peculiar secretion of the skin. The eyes of the shark were more prominent than usual in such forms. A survey of the life-histories of the several phosphorescent groups affords at present no reliable data for the foundation of a theory as to the functions of luminosity, especially in relation to food. No phosphorescent form is more generally devoured by fishes or other animals than that which is not; and, on the other hand, the possessor of luminosity, if otherwise palatable, does not seem to escape capture. An examination of the stomachs of fishes makes this clear, except, perhaps, in the case of the herring, which, however, is chiefly a surface fish. Further, it is not evident that such animals are luminous at all times, for it is only under stimulation that many exhibit the phenomenon.

THE FAUNA OF THE ARALO-CASPIAN BASIN.—There is ample evidence that the waters here had formerly a much wider extension, but the exact time, or times, when this occurred—although geologically recent—has yet to be determined. Dr. S. P. Woodward, in his Manual of the Mollusca, says the Aralo-caspian limestone indicates the former presence of a great inland sea—larger than the Mediterranean—at a time previous to that of the Mammoth and the Siberian rhinoceros. This steppe-limestone rises to a level of 200 or 300 feet above the present level of the Caspian.

The fact of the waters of the Caspian and Aral being only brackish, and by no means very salt, leads me to think that the basin has not been a close one for a *very* long period. General von Helmersen found well-preserved specimens of two kinds of shells, viz., *Cardium edule* and *Dreissena polymorpha*, in the sands of the desert of Harakum. Both these species still live in the Caspian. And Helmersen expresses his belief that the entire country from the Aral on to the sandy deserts of Akkum is an old sea-bottom (Quart. Journ. Geol. Soc., 1869, Vol. xxv, Memoirs, p. 8).

The present surface of the Caspian is eighty-four feet below that of the Black sea, and according to Major Wood, a rise of 220 feet would cause the waters of the Caspian to overflow the watershed of the Tobolsk, a tributary of the Obi.

According to the same authority, a rise of twenty-three feet in the waters of the Black sea would cause it to overflow into the Caspian by the line of the Manytseh.

From these figures it appears that if the level of the Caspian were to rise (84 × 23) 107 feet, its waters would find their way westward into the Black sea, and if the outlet in that direction were blocked so as to permit the surface of the Caspian to rise 220 feet, the waters would escape northward into the Tobolsk and down the valley of the Obi into the Arctic ocean. Now the Caspian at present contains seals, fishes, Crustacea and Mollusca, some of which are either identical with, or very closely resemble those of the Arctic sea. The seal which inhabits its waters (*Phoca caspica*) is so like the common *P. vitulina* that some naturalists consider it to be a mere variety of that species. There are also the beluga, the sturgeon, the herring, the sterlet, and the salmon, some of which are species that go up rivers from the sea. Among the Crustacea is *Idothea entomon*, found in the Kara sea, near the mouth of the Obi, and *Mysis relicta*, another northern species. So that there *are* grounds for supposing that some communication may have formerly existed by way of the Obi with the Arctic ocean. No doubt the waters of the Aralo-caspian basin have undergone many changes of level. Some of the mollusca which still live there, such as the Cardium and Dreissena, appear to be descendants of species found in the Congerian beds of that region, which go back to Miocène times.—*T. F. Jamieson in the Geological Magaziue, May, 1885.*

Amœba infesting Sheep.—Sheep in New South Wales are affected by a disease which appears to be very similar to epithelial cancer, and is met with on the feet behind the hoofs, and also on the lips and nostrils and the gums of lambs. The epithelium in these places grows with pathological rapidity, the horny layer produced soon attains a thickness of $3–5^{mm,}$ the wool drops out in the diseased parts, and below the thick outer layer a festering process sets in. After some time a new epithelium makes its appearance below the festering layer. Then, provided the lamb does not die, the thick horny layer is thrown off like scurf, and the epithelium below attains new wool, and replaces the old skin.

In studying the circumstances in which these sheep live, Dr. R. v. Lendenfeld found that they were invariably exposed to being wounded in those places, which eventually developed the disease, blistered by standing on rocks heated by the sun after they had been standing in water for several hours, or pricked by the spines of the variegated thistle, and it was found by a process of artificial breeding in an aquarium that the disease is produced by an Amœba (*A. parasitica.* n. sp.), which enters the wounds and multiplies rapidly in the epithelium, causing very strong irritation. The organism is found between the layers of horny substance. It does not differ morphologically from the well-known *A. princeps* of Ehrenberg.

Dr. Lendenfeld adds, "It is well known that several fungi in certain stages of their life appear very similar to Amœbæ, and so it is not impossible that my Amœba is in some connection with them. I do not consider this probable, however, as I made no observation which might lead one to suppose that the Amœba ever divided into a multitude of swarming spores."—*Journ. Roy. Micr. Soc., December, 1885.*

Desiccation of Rotifers.—Mr. H. Davis, at a recent meeting of the Quekett Microscopical Club, exhibited some strips of note-paper on which were several groups of dried Philodines (*P. roseola*), looking like clear red spots. These had been sent to Mr. Davis by the Rev. E. T. Holloway, of Clehanger, who had thus succeeded in obtaining specimens of these dried rotifers quite free from sand or dirt of any kind, which has been considered by some to be the only protective.

Dr. C. T. Hudson writes us that "nothing could be more instructive than these curious clusters. In the great majority of cases, each rotifer was seen imbedded in a patch of glutinous secretion, which was divided from the similar patches of the surrounding rotifers by sharp straight lines, so as to give the whole group the appearance of a tesselated pavement. Here and there the Philodines were glued together by long tongues of the same secretion; especially were the fibers of the paper projected above the general surface, and, by spoiling the level, presented the formation of a sharp bounding line. In one case, a rotifer had bored its way into the fibers of the paper, and, unable to withdraw or contract itself, had formed the center of a whole group of others attached to it by radiating bands of glue. In fact, these beautifully clean groups gave ocular demonstration of the truth of Mr. Davis' theory that the Philodines resist drought by encasing themselves in a glutinous case of their own secreting, and the efficiency of the protective was at once shown by putting the strips in water, when the buried rotifers soon struggled into life."—*Journ. Roy. Micr. Soc., February, 1886.*

PARASITE OF THE ROCK OYSTER.—Mr. W. A. Haskell, on examining some samples of oysters which were dying in large numbers, found that most of them, when opened, presented on the inner surface of the shell one or more discolored blisters. In some these were of small extent with a narrow sinuous form, while in many instances a large part of the valve was affected. In some cases, where the extent of the shell invaded was not large, the oysters did not seem at all affected by it; in other cases the animal was found to be dead, and in a few cases the shell was completely empty. In the interior of the blisters were found one or more specimens of a very small annelid, by which the mischief had been effected—*Polydora ciliata.* One specimen of a second species was also obtained, *P. polybranchia*, n. sp., which the author describes.—*Jour. Roy. Micr. Soc., December, 1885.*

SENSE-ORGANS OF COPEPOD CRUSTACEA.—Dr. O. E. Imhof has some notes upon the antennary olfactory organs of the genera Heterocope and Diaptomus.

These appear to have been discovered in Heterocope by Gruber; in Diaptomus they exist in all the species examined, and have a characteristic distribution, which is the same in all the species, and may, perhaps, serve as an additional definition of the genus. The form of the organs in Diaptomus is a little less complicated than in Heterocope; they resemble very closely the corresponding organs of Pontella described by Claus.—*Journ. Roy. Micr. Soc., December, 1885.*

BIRDS BREEDING IN ANTS' NESTS.—The Southern chestnut woodpecker (*Micropternus gularis*), always, as far as I have observed, uses an ants' nest to nest in, and Mr. Gammie, the superintendent of the Government cinchona estates at Mongphoo, near Darjeeling, has noticed the same thing with regard to the allied Northern species, *Micropternus phaloceps*, and the peculiarity probably extends also to the allied species found in Burmah, Siam, &c.

Mr. Gammie thinks that when an ant's nest has been taken possession of by the bird that the ants desert the nest. This is a point on which I cannot speak with certainty. Mr. Gammie has taken nests of the Northern species in which, although the bird had laid, the ants remained, and he has taken other nests where not a single ant remained, but there is nothing to show that these nests were not deserted before the bird took possession. I, myself, have taken nests of the Southern form, in which, though the eggs were partially incubated, the ants remained, showing that some considerable time must have elapsed since the bird took possession. This is a point that I hope to be able to elucidate within the next few months, when the birds will be breeding.

When Micropternus is breeding, the feathers of the head, tail and primaries of the wings are yet covered with a viscid matter, having a strong resinous smell, and this substance is usually rather thickly studded with dead ants (*vide* "Stray Feathers," Vol. VI, p. 145).

Two specimens of kingfishers also to my knowledge nidificate in ants' nests, viz., *Halycon occipitalis*, confined to the Nicobar islands, and *H. chloris*, which ranges from India as far south as Sumatra.

At Mergni, in South Tenasserim, I found a nest of *H. chloris* in a hornet's nest, and although I saw the birds repeatedly enter the hole they had made in the hornet's nest, the hornets did not seem to mind it; but they resented in a very decided manner any attempt to interfere with the nest.—*Wm. Davison, Nature, March 12, 1885.*

The Soaring of Birds.—Mr. Hendricks, in the Naturalist for March, intimates that I misinterpret the phenomenon of soaring, "for it is well known that the upward lateral force would arrest the downward motion, so that the *cause* of the upward motion would be immediately withdrawn."

It would seem that the "downward motion" could only be arrested by resisting the lateral force. On his own showing the gravity of the *body* cannot do it, as this "is descending uniformly through the atmosphere and is therefore meeting with atmospheric resistance equal to its weight" There is no air condensed nor driven out of the way in the lateral motion, so that the only resistance to the lateral force is that of atmospheric friction on the smooth surfaces of the plane, and this is very little.

To enable the weight to resist the lateral force it would have to be created, as the original amount is fully occupied.

As action and reaction are equal and opposite, and normal to the falling surface, the inclination in which that surface lies is a *neutral plane*, and no amount of force acting in that plane can increase or diminish its downward motion.

It is obvious that an incident force at any angle whatever from any direction above the plane would increase the fall, and at any angle or direction from below would diminish it, while in the plane, from any direction, its motion would neither be increased nor diminished but remain unchanged.

There would simply be a motion added to the body, in its own plane, in the direction of the impressed force and proportional to it.

I can detect no "error" arising from "a misconception of the phenomena of resulting motion." The body falls with uniform speed, constituting one of the factors of soaring. It is then moved laterally on an upward incline, which is the other factor. These *result* in the level motion of flight in obedience to the law of all resultant motions.

It seems like a covert attempt on the part of Mr. Hendricks to lodge a perpetual motion scheme with the soaring problem. I am confident that no such fallacy can be domiciled within its precincts.—*I. Lancaster, 335 Wabash avenue, Chicago.*

Zoological News.—*General.*—The deep-water fauna of Lake Leman, if the line between it and the littoral fauna be drawn at thirty metres, at which depth chlorophyll-forming vegetation ceases, consists of about 100 species: Fishes, 14; insects, 3; Arachnida, 19; Crustacea, 16; Hydroidea, 1; Rhizopoda, 13; Cilioflagellata, 1; Gasteropoda, 4; Lamellibranchiata, 2; Annelida, 4; Nematoidea, 3; Cestoidea, 1; Turbellaria, 18; Bryozoa, 1; Rotifera, 2. Most of these are evidently the descendants of the inhabitants of the shallow waters, and differ chiefly in their smaller size and duller tint; but M. Forel maintains that *Niphargus puteanus*, var. *forelii*, and *Asellus forelii* are descended from *Niphargus puteanus* and *A. cavaticus* of the wells of Europe, the resemblance being too close to have been arrived at independently.——The Limneas and Chironomus larvæ which inhabit the deep waters of Lake Leman, breathe water instead of air, *i. e.*, the tracheæ of the one and the pulmonary sacs of the other are filled with water. Larvæ of the dipterous insects abound, but pupæ are rare or absent, and perfect insects are never seen to rise from the surface of the deeper parts of the lake; moreover, larvæ of all sizes and ages are found at the bottom at the same season. This makes it probable that these larvæ never attain the perfect stage, but are capable of reproduction by pædogenesis.

Mammalia.—Carnivora are still common in the north of Europe. The "Statistical Year Book" for Finland states that in 1882 not less than 85 bears, 128 wolves, 407 lynxes, 4005 foxes, 76 gluttons, 240 otters, 143 martens, 1583 ermines and 3947 carnivorous birds were killed and paid for by the Government. The losses during the same year from Carnivora were estimated at 274 horses, 846 cattle, 5246 sheep, 168 pigs, 119 goats, 1681 reindeers and 2366 chickens.

Crustacea.—The Crustacea of the Norwegian North Atlantic Expeditions, excluding forms previously established as belonging to the Norwegian littoral fauna, have been described by G. O. Sars. They comprise: Brachyura, 1 sp.; Anomoura, 1; Caridea, 4; Mysidæ, 5; Cumaceæ, 1; Isopoda, 18; Amphipoda, 45; a copepod, *Eucheta norvegica*, always found at considerable depths, six cirripeds and *Stylon hymenodore*, a rhizocephalon attached parasitically to the abdomen of *Hymenadora glacialis*, and dredged in 1861 fathoms.——*Bythocaris leucopis* and *payeri*, true deep-sea carideans of the North Atlantic (1110 fathoms), do not pass through the usual larval stages, but on quitting, the remarkably large embryos have the full number of appendages found in the parent. *Hymenodora glacialis* has an exopodite attached to the outer side of the second joint of the legs, as in the schizopods. ——*Boreomysis scyphops*, a schizopod taken by the Norwegian North Atlantic expedition has very singular eyes. The outer surface of these organs is concave, they are attached close together, and are destitute of any specific ocular pigment.——*Sphyrapus serratus* Sars, is a singular sightless isopod which occurs in the open sea between Norway and Iceland, at depths of from 1163 to 1333 fathoms. It has nineteen paired appendages. The first pair of legs springing from the posterior part of the cephalic segment, are powerful prehensile organs. The second pair of legs are as long as the body, flattened, and armed with powerful spines. Five pairs of slender walking feet follow, and are followed by five of biramous swimming feet and a pair of long branched and many-jointed caudal appendages.

EMBRYOLOGY.[1]

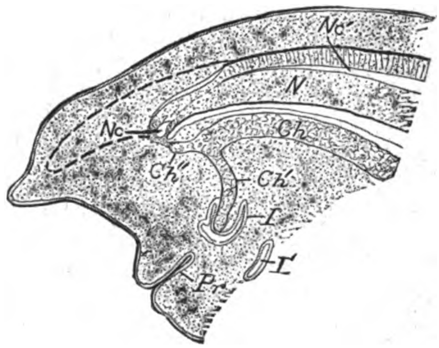
On an Unusual Relation of the Notochord to the Intestine in the Chick.—Through the great kindness of Dr. G. Baur, of the Peabody Museum, New Haven, Conn., I am enabled to figure an apparently rare mode of development of the notochord in the embryo chick. In order to enable the reader to more readily understand the peculiar morphological relations to each other of the posterior ends of the nervous cord, chorda and intestine in the series of sections prepared by Dr. Baur, I have endeavored to combine in one figure what seemed to me to be a correct interpretation of the relations of the parts involved.

The series of sections loaned me and from which I am kindly permitted to figure such portions as are of interest in this connection, were prepared from an embryo of the seventh day. The

[1] Edited by John A. Ryder, Smithsonian Institution, Washington, D. C.

sections consist of a vertical longitudinal series, which show the structural details represented in the accompanying figure, drawn with the aid of the camera lucida.

The most striking feature is the condition of development presented by the notochord *Ch*, which bifurcates posteriorly into two branches, namely, a ventral one, *Ch'*, and a posterior or dorsal one, *Ch''*. The ventral branch *Ch'* is in close relation to the hindermost portion of the mesenteron *I*, while the posterior or dorsal branch *Ch''*, which really seems to be the posterior continuation of the chorda proper, is closely connected with the under side of the hinder portion of the nervous cord *N*. In fact, there is a readily traceable bridge of tissue between the end of *Ch''* and the under side of *N*, which conclusively demonstrates that these two structures were at an earlier stage continuous. Just above this bridge of tissue there is a cavity, *Nc*, which must in all probability be regarded as a persistent portion of the neurenteric canal, which has been dilated into a vesicle at this point. Certain sections of this series, from a slightly different plane, show that the nervous cord *N* extended back somewhat beyond the point where the notochord joined it, as shown by the dotted outline in the figure. The notochord itself, however, I cannot trace farther back than is shown in the figure, though there are somites developed beyond its termination.



Explanation of Figure.—*Ch*, chorda dorsalis; *Ch'*, portion of chorda developed about the ventral end of the neurenteric canal; *Ch''*, hinder portion of chorda joined posteriorly to the medulla spinalis *N*; *Nc*, vesicular cavity just above the point of union between the medulla spinalis and chorda, and representing a dilatation of the neurenteric canal; *Nc'*, medullary canal; *I* and *I'*, posterior part of mesenteron; *Pr*, proctodæum. × 21.

Judging from what has preceded, it is evident that a connection between the central neural canal *Nc'* and the developing chorda and intestine once existed in this embryo. The central canal *Nc'* is, I believe, traceable to the cavity *Nc* farther back, just below which the neural tube is continuous with the chorda. It seems, in fact, not improbable that the single point of connection between the chorda and nervous cord represents the atrophied neurenteric canal, and that the portion of it which joined the intestine passed down through *Ch''* and *Ch'*. Even supposing that the condition of things observed in this particular embryo is not normal, it is easy to conceive that this specimen may represent a palingenetic type of avian development, comparable with such an one as has been described by Hoffmann[1] in *Anas boschus*, in which the canalis neurentericus is shown (pl. III, fig. 5) to open into the intestine while a canal also extends from it anteriorly into the chorda itself. Such is essentially the arrangement in the specimen here described, except that the chorda has been differentiated along the entire extent of the neurenteric canal.

The arrangement of parts in the more advanced duck embryo figured by Balfour (Comp. Embryol., II, p. 136), is likewise reconcilable with that observed in the preparations made by Dr. Baur. In Balfour's account of the development of this region in the duck, the condition which has persisted in the specimen here under consideration has been described. He says: "The [neurenteric] passage leads obliquely backwards and ventralwards from the hind end of the neural tube into the notochord, where the latter joins the primitive streak. A narrow diverticulum from this passage is continued forwards for a short distance along the axis of the notochord. After traversing the notochord, the passage is continued into a hypoblastic diverticulum, which opens ventrally into the future lumen of the alimentary tract." It is clear from the figure that this must have been the case in the specimen here under consideration; that is, the neurenteric passage about which notochordal tissue was differentiated was continued forward into the chorda, as the latter was folded off from the hypoblast, and that from this passage in the chorda one passing downward to the intestine was given off about which notochordal tissue was also differentiated.

While it is highly probable that this embryo chick displays an archaic development of the chorda, yet the facts are significant, especially when viewed in the light of the interpretations of Ehlers as to the significance of the "*Nebendarm*" in the invertebrates. This specimen shows that what must have been a part of the neurenteric canal during an earlier stage, *i. e.*, *Ch'*, has been actually differentiated into a structure histologically identical with the true axial notochord *Ch*.

This specimen is therefore of great interest, since it demontrates, if we may regard it as representing a palingenetic condition of development, that the chorda dorsalis was primitively in absolute continuity with the intestine (mesenteron) posteriorly, and that there may therefore have been primitive Chordata in which the chorda was usually developed as such, in almost absolute continuity with the alimentary tract.—*John A. Ryder*.

Professor Selenka on the Development of the Opossum (Didelphys virginiana).—The following short notice of the recent investigations of Professor Emil Selenka, of Erlangen, on the development of the common opossum, although it has ap-

[1] Die Bildung des Mesoderms, die Anlage der Chorda dorsalis und die Entwickelung des Canalis neurentericus bei Vogelembryonen. Naturk. Verh. der Koninkl. Akad. Wetensch. XXIII, Amsterdam, 1883.

peared some time since in a foreign journal,[1] seems to us of such unusual interest that we render in English the author's text in full as follows:

"For a number of years I have been intending to trace more accurately the development of some marsupial. The study of this archaic group promises to clear up a number of problems which the study of the embryology of placental mammalia has given rise to, but which that study has hitherto not been in a position to solve, such, for example, as the significance of the peculiar mode of development of the germinal layers in the Placentalia, the conversion of the transitory respiratory organs into an apparatus for the nutrition of the embryo, and further, the higher differentiation of certain organs (the brain, auditory apparatus, diaphragm, etc.)—questions, the solution of which may at the same time explain the origin of the Mammalia.

"During my stay in Brazil (there at that time winter), I found that no sexually mature marsupials were to be had, and since I could obtain but little material, and only such as was unsuitable at that, from the zoölogical gardens of Holland and Germany in the course of years, I resolved to attempt to rear these animals at Erlangen.

"More than two years since, I obtained eight young Brazilian opossums, which promised to do well, but all of which died, one after the other, before they were full grown. Last autumn, however, I obtained, through the kind efforts of Mr. Karl Hagenbeck, of Hamburg, a large number of the hardy North American opossum; in a warmed and well-ventilated stable, these animals, which were well fed, survived the winter remarkably well, and all of them, except a few individuals which were suffering from an affection of the liver and spleen, began rutting during the past spring. Seven females furnished within a few weeks about one hundred embryos, representing the greatest range of stages of development. To obtain such favorable results, various methods of artificial interference had to be resorted to, a description of which is not in place here. Nor would I anticipate the complete account which will appear in the course of the present year, so that I shall now only record some observations on the rutting of these animals and the development of the blastodermic vesicle.

"1. In each spermatoblast of the male, two spermatozoa are developed, which, however, remain united for a remarkably long period. The mature spermatozoa, which are taken from the vagina of the female immediately after copulation, are almost all such twin-cells with double flagella; only after some time do they separate as a consequence of the remarkably strong and rapid vibrations of the flagella—they are literally thus torn apart.

"2. The rutting period of the female occurs at night and dur-

[1] Ueber die Entwickelung des Opossums (*Didelphys virginiana*). Biolog. Centralblatt, v, No. 10, 1885, pp. 294–295.

ing the morning hours and lasts only half a day. If copulation does not take place during this period, the female may rut again in the course of several weeks. Such females also from which the young are prematurely removed from the pouch or marsupium, allow themselves to soon again become pregnant. During the rutting period the walls of the uterus thicken very perceptibly, and principally because of the enlargement of the uterine lymph-spaces, in which the uterine glands then appear to be suspended and to float.

"3. The fertilization of the eggs always occurs five days after copulation and at the lower end of the oviduct, where the latter widens into the uterus. In the vermicularly bent oviducts no spermotozoa are encountered.

"4. Gestation lasts for exactly eight days; then thirteen days after copulation the young are transferred to the marsupium. Development accordingly proceeds with extraordinary rapidity. Only three days before birth do the amniotic folds close over the back of the embryo.

"5. The egg is intermediate in character between the meroblastic and holoblastic type. During segmentation, there is aggregated at the aplastic pole of the egg a nutritive yolk, which at first lies quite outside of the ectoderm, though three days later the neighboring ecto- and mesodermal cells grow over the yolk, which thus becomes surrounded or imbedded by them, but the yolk is never included by the umbilical vesicle (intestinal or entodermal cavity)! Remnants of the yolk persist up to the third day before birth.

"6. The fertilized but unsegmented egg measures almost $.5^{mm}$ in diameter; in the course of twenty-four hours the blastodermic vesicle measures 1^{mm}; in thirty-six hours 1.5^{mm}; in sixty hours 4^{mm}; in seventy-two hours 8^{mm}; in ninety-six hours 14^{mm}, and on the sixth day after the commencement of segmentation as much as 20^{mm} in diameter.

"7. The blastodermic vesicles at first lie quite free and scattered in the uterus; on the fourth day (after the beginning of segmentation), the blastodermic vesicle over the germinal area becomes very loosely adherent to the uterine epithelium.

"8. In the marsupium of the mother there were never more than six young observed. But the number of embryos [found in the uterus] is invariably much greater and varies, according to the size and strength of the female, from nine to twenty-seven."

PHYSIOLOGY.[1]

THE ACTION OF SULPHATE OF SPARTEINE ON THE HEART.—The alkaloid sparteine was discovered by Stenhouse in *Spartium scoparium*, a species of Genista, in 1850. It is a bitter liquid, insoluble in water. Treated with an excess of sulphuric acid, it forms a

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.

salt which crystallizes, and dissolves readily in water. M. Sée has made clinical observations with the use of this drug and, according to his results, it is of most extraordinary value in the treatment of various forms of cardiac trouble. Doses of 0.1 gramme of the sulphate of sparteine when given to a patient produced no disturbance of the digestive or nervous system; its effects seemed to be limited to the heart. In fibrous cardiac degeneration a single dose rendered the pulse-tracing normal for the period of three or four days. In irregular rhythm of the heart-beat due to insufficiency of the auriculo-ventricular valves or to contraction of their orifices, the drug brings back the normal rhythm. Three results follow the exhibition of sulphate of sparteine: 1. Its restorative effects upon heart and pulse; in this respect it equals digitalis, and its tonic action is very much more prompt, pronounced and lasting. 2. As a regulator of the rhythm of heart-beat, it stands unrivaled. 3. It causes acceleration of the pulse, and approaches belladonna in usefulness where need of the latter drug is indicated.—*Comptes Rendus, T. ci, p. 1046.*

The Microbe of Hydrophobia.—M. Fol has found in sections of the spinal cord and brain of animals dead from rabies, a micrococcus which he thinks is peculiar to that disease, and probably its etiological factor. The fresh tissue is hardened in a solution of 2.5 per cent bichromate of potash, and 1 per cent sulphate of copper, and the sections are stained with hæmatoxylin. The micrococci are lodged usually in the neuroglia, but more rarely in the nerve-fibers themselves. An artificial culture of the micrococci in healthy cerebro-spinal fluid produced characteristic hydrophobic symptoms in animals which received injections of it in the brain. —*Comptes Rendus, T. ci, p. 1276.*

The Transformation of Peptones by the Liver, and the relation of the Sugar in the Blood to the Nature of the Food Supply.—As previously reported in these pages, Professor J. Seegen, of Vienna, undertakes to prove that the peptones absorbed from the alimentary canal are destroyed in the liver, giving rise to sugar as one of the products of decomposition. If this hypothesis be correct, we must expect that some other body containing the nitrogen of the peptones must be formed at equal rate with the sugar. It was to establish this fact that Seegen's later work was undertaken. The following method was finally adopted as likely to give results most free from error: Two pieces were cut from the liver of a dog just killed, weighed and finely minced. The portions were placed in two glass vessels containing from 50 to 100^{cc} of defibrinated blood from the same dog. To the blood in one of the vessels a peptone solution was added, and to the other a like volume of pure water. By means of aspirators a stream of air was passed through each vessel for the period of three to five hours. At the end of that time a given quantity of blood was drawn from each vessel, all albuminous matters were precipitated with great care, and the fluid remaining was tested, after concentration, as to its content of nitrogen. The author discusses fully various methods employed in the separation of minute quantities of albuminous substances from complex mixtures. The results of these experiments indicate a very considerable destruction of peptone by the liver with the formation of a corresponding amount of a nitrogenous product of the decomposition.

Seegen was led to the choice of peptone in his study from the fact that Schmidt-Mülheim had found that most of the albuminous bodies digested in the stomach were changed to peptones, and because the researches of Plosz and Gyergyai had showed that the blood of the hepatic vein contained but traces of peptones, while that of the mesenteric veins was rich in them, the conclusion being that the liver was the principal seat of the destruction of peptones. In respect to the formation from peptones of carbohydrates by the liver, the author found that, in experiments performed in the manner described above, not only was the sugar content of the peptone-liver-blood increased 20-70 per cent above the liver blood without peptone, but the total amount of carbohydrates was increased as well. The conclusion is reached that the function of the peptones, at least in carnivorous animals which are not changing in weight, is, for the most part, to give rise to the formation of sugar in the liver.

In another article the same author discusses the influence of variation and nature of the food supply on the presence of sugar in the blood. In the hungering animal (dog), the blood of the hepatic vein is constantly richer in sugar than that of the portal vein, the relative amounts being nearly two to one. The formation of sugar is, then, a continuous function of the liver. Calculation shows that it is hardly possible that this sugar formed during hunger could have come from previously stored carbohydrates. When an animal is fed on food rich in starch, the sugar content of the portal-vein blood is only very rarely increased; the large amount of sugar in the hepatic vein cannot therefore owe its existence directly to sugar entering the liver.

The percentage of sugar in arterial blood is nearly constant in the various conditions of hunger, or when the animal is fed upon starch, dextrine or sugar; the blood from the carotid artery, however, holds a slightly greater amount of sugar during the hours when sugar is being most rapidly absorbed from the alimentary canal.

The blood of the portal vein contains the same percentage of sugar on a starch diet as in hunger, but the sugar content increases when sugar is taken in the food, and to a still greater extent when a mixture of sugar and dextrine is eaten. The blood of the hepatic vein always contains a larger percentage of sugar than that of the portal vein, not only during hunger, but after all manner of carbohydrate diet. The formation of sugar in the liver has nothing to do with the sugar ingested with the food. The formation of sugar by the liver persists throughout a prolonged period of inanition, and is not increased when a large amount of carbohydrate is fed to the animal. Seegen does not believe that the glycogen found normally in the liver is the source of the sugar of the hepatic vein; it probably has some special destiny, perhaps the formation of fat. The amount of glycogen found in the liver stands in very close relation to the amount of carbohydrate in the food.—*Pflüger's Archiv., 1885, pp. 325 and 348.*

PLETHYSMOGRAPHIC AND VASO-MOTOR EXPERIMENTS WITH FROGS. —Dr. Ellis has followed Drs. Bowditch and Warren in a series of investigations which bids fair to open the way to much that is new and valuable concerning the vaso-motor mechanism. The latter observers studied by the graphic method the variations of volume produced in the hind leg of a curarised cat by electrical stimulation of the sciatic nerve. The volume of the limb was measured by the plethysmograph, and any fluctuations in it could only be due to variation in the amount of blood supply. The authors found when the peripheral end of the nerve was excited by rapidly repeated induction shocks (16–64 per sec.), there was usually contraction of the vessels. When a slower rate was employed (4–0.2 per sec.), there was dilatation. With a medium rate of stimulation there followed first a narrowing and afterward a dilatation. A latent period of 1.5 sec. preceded the constriction, and one of 3.5 sec. the dilatation. The latter effect sometimes persisted for several minutes after cessation of the stimulation, but the former usually ceased with it.

By an exceedingly ingenious application of a test-tube plethysmograph connected with very delicate registering tambours, Dr. Ellis has been able to study the vaso-motor changes produced in the leg of curarised frogs by stimulation of the sciatic nerve. The general results agree very well with those already obtained on the cat. In general, slow interruptions (1 or 2 per sec.) caused dilatation, while rapid stimulation (15 per sec.) caused contraction. The author remarks: "In studying the varying effects of electrical stimulation upon the blood-vessels, several factors must be considered. 1. *The intensity of the induction shocks.* The greater the intensity of the shocks, other conditions remaining the same, the greater the tendency to immediate contraction on the part of the blood-vessels. The converse of this is in a measure true, namely, the weaker the stimulus, the greater the tendency to immediate dilatation. 2. *The number of induction shocks per second.* The greater the number of shocks per second, the greater the liability to contraction, and conversely. 3. *Duration of the stimulation.* The longer a series of weak shocks rapidly following one another is applied, the more likely is it to cause contraction."

The intensity of the slowly repeated shocks which produced dilatation, was usually much greater than that of the rapid stimulation which caused constriction; but when the total stimulations to which the nerve is subjected, obtained by multiplying the intensity of each shock by the number of shocks applied, are compared in the two cases, it is found that when dilatation is obtained, the total stimulation is much less than when constriction is caused. These experiments indicate the existence of two separate peripheral vaso-motor mechanisms, one having the function of vaso-constriction, and the other of vaso-dilation.—*The Journal of Physiology, Vol. vi, p. 437.*

PSYCHOLOGY.

ANTHROPOLOGY AND PSYCHOLOGY.—At the Aberdeen meeting of the British Association for the Advancement of Science, Dr. Alexander Bain, lord rector of Aberdeen University, read a paper "On the scope of anthropology, and its relation to the science of mind." He endeavored to point out that the bringing together of the six departments—named respectively man's place in nature, the origin of man, the classification of races, the antiquity of man, language and the development of civilization—did not contribute to the mutual elucidation of the several topics, but merely concentrated into a whole the subjects connected with the higher mysteries of man's origin and destination. He next dealt at length with a survey of the researches having in view precise measurements of the bodily and mental characteristics of human beings, and indicated lines on which research might be made so as to reflect new light on our intellectual constitution. The author also reverted to the research into the conditions and the measure of memory as wholly within the means of actual experimental determination; also the important intellectual function of seeing similarity in the midst of diversity, which can be reduced to more or less precision of estimate by suitable means. Taking along with these results the inquiries into the faculties of the lower animals, the author put special stress on the number and delicacy of their senses as the foundation of every attempt to explain the higher aptitudes. Intelligence commenced with the power of discrimination, and increased as that power increased. The record of marvelous feats of exceptional ingenuity was of very little aid in revealing the secrets of the animal mind. In conclusion, he urged the admission of psychology in a more avowed and systematic form into the anthropological section. He would exclude the topics of metaphysical and ethical controversy, and welcome all the researches into the intellectual and emotional regions of the mind. Dr. Burdon Sanderson said any one teaching physiology would not be expected to include anthropology, and Dr.

Bain had shown why it was not done. That was because when we came to the higher functions of man, called mental functions, we had to do with perceptions which were founded upon sensation, which meant interpretations by the mind of those perceptions. He considered that the line at which physiologists stopped was the line at which Dr. Bain begins—namely, measure. He heartily agreed with Dr. Bain in thinking that psychology is the subject that lies at the basis of anthropology, and should be accepted as its foundation.

PHILADELPHIA BRANCH AMERICAN SOCIETY FOR PSYCHICAL RESEARCH.—The Philadelphia Branch of the American Society for Psychical Research holds meetings monthly. It has organized with committees on thought transference, hypnotism and spiritualistic phenomena, and entered upon the lines of collective investigation, followed by both the American and British societies. The committee on thought transference has collected the results of some twelve thousand experiments conducted by a number of observers, and a statistical study of these seems to show a slight preponderance of right guesses when the conditions are such as render thought transference possible.

A special committee has been inquiring into the subject of faith-cure; but without attaining anything in the way of positive results. Some of the most frequently described cases of marvelous cures were, on investigation, found to be without any sufficient basis in fact. In general, the "faith-curists" seemed to dread and abhor anything like a scientific investigations of their claims; so that any careful study of the psychic phenomena which attend the cure of even those nervous and illusive maladies that are known to be amenable to mental impressions, was out of the question. Other standing and special committees will report at the regular meetings of the branch.

ANTHROPOLOGY.[1]

MAORI PHARMACOPŒIA.—Mr. Kerry Nichols has preserved for us in the Journal of the Anthrop. Inst. (xv, 206) the native medicines of the Maoris of New Zealand:

Harakeke (*Phormium tenax*), New Zealand flax, decoction of leaves and root used for *paipai*, a cutaneous disease.

Horopito, a shrub, decoction of leaves used for *paipai*.

Huhu, a grub found in the *rimu* (*Dacrydium cupressinum*), *matai* (*Podocarpus spicata*) and *kahikatea* (*Podocarpus dacrydioides*), eaten as medicine.

Kahikatea (*Podocarpus dacrydioides*), decoction of leaves used for internal complaints.

Kareas (*Phipogonum scandens*) decoction of roots used as sarsaparilla, young shoots eaten for itch.

Kawakawa (*Piper excelsum*), leaf used for the *paipai*, and to heal cuts and wounds.

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

Kohekohe, a powerful tonic; a weak infusion of the leaves stops the secretion of milk.

Kohukohu, a lichen, when dried and reduced to powder is applied to cutaneous eruptions.

Kokakapa (Trichomanes), the leaf is used to heal ulcers.

Koromiko (*Veronica sulcifolia*), an infusion of the leaves is a powerful astringent; a weak infusion a tonic; the leaves are applied as a poultice for ulcers; a decoction of the leaves is valuable in dysentery; a small portion of the leaf, if chewed, soon produces a keen sense of hunger.

Mamahu (*Cyanthea medullaris*), the bruised pith is used as a poultice for sore eyes.

Miro (*Podocarpus ferruginea*), a weak infusion of the bark is taken for stomach ache.

Mouku, an edible fern; a wash obtained from the root is good for sore eyes.

Ngareku, charcoal powdered fine, is used for cutaneous diseases.

Papanuga, the infused bark is drunk for the *hakihaki*.

Papa-auma, or mistletoe, the bruised bark is applied for the itch by rubbing it over the skin.

Paretau (*Asplenium oblequum*), a large-leaved fern, the root is used for *paipai*.

Patete, the sap is used for scrofulous sores and ringworm.

Bohutakawa (*Metrosideros toamentosa*), an infusion of the inner bark is used for diarrhœa.

Pukatea (*Atherosperma novæ zelandiæ*), the bark is used for scrofulous sores.

Raorao (*Pteris esculenta*), tender shoots used for dysentery.

Rata (*Metrosideros robusta*), infusion of bark used for dysentery.

Rauriki, or sow-thistle, an infusion is used for stomach complaints.

Rimu (*Dacrydium cupressinum*), an infusion used to heal running ulcers.

Tawa (*Nesodaphne tawa*), bark used for stomach aches and colds.

Ti (*Cordyline australis*), an infusion of the leaves used for dysentery.

Taotao (*Phyllocladus trichomanoides*), leaves used for scrofulous diseases.

Tutu (*Coriaria ruscifolia*), tender shoots, when plucked at certain seasons, are taken for dysentery.

THE LAPLANDERS.—In Journal of Anthrop. Inst., XV, will be be found communications from Prince Roland Bonaparte, Dr. J. G. Garson and Professor A. H. Keane respectively, upon the Lapps, that of the latter being very full. There are, at present, 25,367 Lapps, although at least 7000 are of mixed Finnish blood. They are divided into upland or nomadic, and lowland or fishing and agricultural divisions. Their name is involved in obscurity, the people call themselves Samé, "Fenmen," Finlanders. They would appear to be an offshoot of the great Finno-Tartaric (Malo-Altaic) family. They are brachycephalic (80° to 83° 50′), short in stature (five feet and less), with brown hair, flushed complexion, brown eyes, straight and regular nose.

The upland Lapp's life is dependent on the reindeer, whose "flesh being mostly dried is converted into jerked meat, whose offal is boiled and eaten fresh, whose blood is congealed, pulverized and kneaded into cakes or used as soup; the milk taken fresh or frozen in a slightly fermented state, or made into cheese for winter store. The skin covers the tent floor, the bed and the body; the sinews make excellent cordage, and the bones, after extraction of the marrow, are carved into many useful and fanciful articles." The herds range in number from 100 to 2000 and upwards.

There are two classes of these nomads, those who remain with their herds during the year, and those who from May to August leave their flocks and take to fishing. The Lapp is assisted in the care of his herd by a very intelligent race of dogs. The sledges are of three kinds:

Kerres, in which the traveler sits as in a boat.

Lakkek, for freight, decked over.

Pulkan, sledge proper, half covered, used on important occasions.

The snow shoes are six to seven feet long and three and a half to four inches wide, used either in walking or when the owner is drawn by reindeer.

Mr. Keane closes his deeply interesting paper with references to the social life, the religion and the language of the Lapps.

Dr. Garson gives a close anthropometric description of a family of Lapps exhibiting in London.

RELATIONSHIPS BETWEEN ESKIMO TRIBES.—Dr. Rink gives a short paper in Journal of the Anthrop. Inst. on the relationship of the Eskimo tribes as determined by dialects. The following table illustrates the order of thought:

ABORIGINAL INLAND ESKIMO.

- Principal stem. Eskimo proper.
  - Eastern.
    - III. Middle regions. Iglulik, Repulse bay, Churchill.
      - I. Greenlanders.
      - II. Labradorians.
    - IV. Mackenzie.
  - V. Western.

Northern.	Southern.
1. Pt. Barrow.	6. Tschugazzes.
2. Kaviagmut.	7. Kadjagians.
3. Malemut.	8. Kangeugdlit.
4. Unaligmut.	
5. Ekogmut.	
9. Asiatics.	

- Side branch. Aleutians.

ARCHÆOLOGICAL MAP.—The Numismatic and Antiquarian Society of Philadelphia has undertaken the preparation of an archæological map to embrace the valleys of the Delaware and Susquehanna rivers. This map is intended to show the location of all the principal remains attributed to the Indian tribes who formerly occupied these regions, including the contiguous portions of Pennsylvania, New York, New Jersey, Delaware and Maryland. Accurate information is solicited concerning Palæolithic gravel deposits, artificial shell-heaps, cave-retreats, encampments or village sites, earthworks, old fields, quarries, workshops, surface deposits of implements (caches), large rocks in place used as mortars, rock inscriptions (in situ), burial places, tumuli or mounds, Indian trails. The circular of the society is signed by Edwin A.

Barber, John R. Baker, Henry Phillips, Jr., Francis Jordan, Jr., Stewart Culin, Daniel G. Brinton. Communications should be addressed to Henry Phillips, Jr., No. 104 S. Fifth street, Philadelphia. The society is to be congratulated for its energy in this matter. The City of Brotherly Love was once headquarters of anthropology in America.

The Revue d'Anthropologie.—The most celebrated of the many French journals devoted to the science of man, was founded in Paris by Paul Broca, in 1872, and continued by his pupil, Dr. Paul Topinard, after the death of the former. A third series was commenced with 1886 with the coöperation of the most distinguished representatives of the various branches of anthropological science; among them Dr. Gavarret, director of the Ecole d'Anthropologie de Paris; Dr. Mathias Duval, director of the Laboratoire d'Anthropologie a l'Ecole des Hautes Etudes; Marquis de Nadaillac; General Faidherbe, High Chancellor of the Legion of Honor; Professor A. de Quatrefages, at the Museum of Natural History; Dr. Hamy, of the Musée Trocadero; L. Rousselet; Jules Rochard; Baron Savoy and D'Arbois de Jubainville, of the French Institute. Dr. Topenard, the director of the Revue, is general secretary of the Société d'Anthropologie de Paris, and author of the Eléments d'Anthropologie, to which the Académie des Sciences, awarded one of its annual prizes.

The Races of Men.—The latest attempt to find a rational expression of racial differences among mankind is by Mr. James Dallas, curator of the Albert Memorial Museum, Exeter. The author is in accord with the general tendency to see three principal groups of humanity, as follows:

Leucochroi, represented by the European.
Mesochroi, represented by Mongols and American Indians.
Æthochroi, represented by Negroes and Australians.

In the Æthochroic group, Mr. Dallas would include Berbers, Nubians. Even admitting that this type extended into Arabia, there would still be an enormous gap between this and the nearest Eastern appearance of the Æthochroic group in India. The Kuhlis, Bhils, Gonds and Konds of India; Mincopies, of Andaman; the Negritos and Samangs of the Philippines, and the Malay archipelago; the Papuans and other pelagian negroes; the Australians and Tasmanians all belong, according to the author, to one great type.

Although the Æthochroic group is spread over an immense area, "the changes in physical geography requisite to bring all these into communication are far from great. An elevation of one hundred fathoms would join all the islands from Cochin China to Java, including Borneo; New Guinea would be joined to Australia, and the narrow seas which would exist between the remaining islands would offer no great barrier to the migration of man. A yet greater elevation would convert the Bay of Bengal into dry land, join the Andamans to India, the Laccadive and Maldive islands to Arabia, converting the Arabian sea into a broad expanse of nearly level ground." At the same time a great geological barrier would be erected against the northern movement of this type. "Thus we have an area to no small extent demonstrably cut off from the northern regions of Asia and Europe, in which alone traces of the Æthochroic group are to be met with, and the Æthochroic peoples were originally the sole occupiers of this area." Mr. Dallas relies largely upon facts connected with the distribution of apes and other mammals to bear him out in his views regarding the spread of the Æthochroi. As regards the purity of this group it is supposed that two developments, one in Africa, the other in the Philippines and Andamans, almost pure, still exist. In the other areas the stock is much mixed.

Roughly speaking, the Leucochroic group occupies the whole of Europe with the exception of a part of the northern portion, and parts of Hungary and Russia. Eastward, members of this group exist in the Caucasus, Armenia, Persia, Georgia, Circassia, Afghanistan, Kashmir, and Hindustan, Kattiwar and Rajputana, and include the Siah Posh Kafirs of the Indian Caucasus, and remnants in China, Tartary, Japan, Kurile island and Kamtshatka. Indeed, Mr. Dallas looks for the origin of this type in the heart of what is now the Mongol area, the plateau of Central Asia, believing that they extended along the eastern coast of Asia from Kamtshatka on the north to the limits of the Æthochroi on the south. From this central region the Leucochroic race passed westward by the great depression, the Zungarian strait, to overrun first Western Asia, and eventually the whole of Europe, branches being thrown out wherever geographical confirmations offered the way. In this distribution the wolf, otter, sheep, mole and marmot are taken as parallels among mammals. The Aino and the Gothic races are assumed to be tolerably pure examples of this stock.

The Mesochroi occupy the two Americas, the whole extent of the eastern shores of Asia from Kamtshatka to Siam, and thence stretch westward to the Bay of Bengal. North of the Himalayas they occupy the original seat of the Leucochroic group, and thence spread over Western Asia, following the route formerly taken by the Leucochroi. The Malays, Polynesians, Lapps, Fins and Basks are relegated also to this type. The original center of distribution and the lines of march in this group are less intelligible. The extinct rhinoceros is taken as the parallel in migration. Intimations are also given that the course of population was from Europe to America, and thence to Asia.—*Journal Anthropological Institute, xv, 304.*

ANTHROPOLOGICAL NEWS.—A German treatise of Ernst Kuhn "on the origin and languages of the transgangetic nations" was published in the Transactions of the Bavarian Royal Academy (1883, pp. 22, 4to), and gives a lucid sketch of racial and linguistic facts observed in China and Indo-China by recent investigators. Kuhn thinks that the autochthonic population of the Indo-Chinese peninsula are the people of Annam, Kambodja and Pegu, and that the intruders who drove them to the coast, came originally from Western China, like the Tibetans; that the monosyllabism of all these languages is not original, but only the result of condensation of a former polysyllabic status; that the Tibetan language has retained the most Arabic forms of the western group of dialects; that the Kambodja is not a Malayan language, as it has been asserted by Aymonier and Keane; that the series of numerals proves ancient affinity of Chinese with Barma (Burmese), Siamese, Lepcha and Tibetan.——The Lord's Prayer, translated by E. H. Man into the South Andamanese language, has been fully commented by R. C. Temple, and edited by him with a scientific preface and introduction on that curious agglutinative language, which had never been previously investigated in a philosophic manner.——The interpretation of the local names of Celtic origin in France, Germany and Italy forms a *crux interpretum* of a peculiar kind for local etymologists, for the simple reason that the ancient Celto-Gallic language and its dialects is almost entirely lost to us. It has been preserved in about twenty or thirty short inscriptions only, which are very differently translated by the scientists, and in a considerable number of personal, tribal and local names, most of which are just as enigmatic as the above inscriptions. The coeval languages of the Greeks and Romans, Oscans and Umbrians being of the same linguistic family, some light is thrown upon the Celtic from that quarter. Dr. Quirinus Esser, inspector of schools at Malmedy, Prussia, has brought to bear all the resources of modern linguistics upon the elucidation of these local names of Middle Europe, as Ruhr, Rezat, Gürzenich, Kanzach, Créteil, Doubs, &c., through the historical method, in his Beiträge zur gallo-keltischen Namenkunde, Malmedy, 1884, pp. 128. Another series of local names, Celtic and Romanic, were learnedly investigated by the same author in a series of articles published in the *Kreisblatt für Malmedy*, at St. Vith, the county seat.—*A. S. Gatschet.*

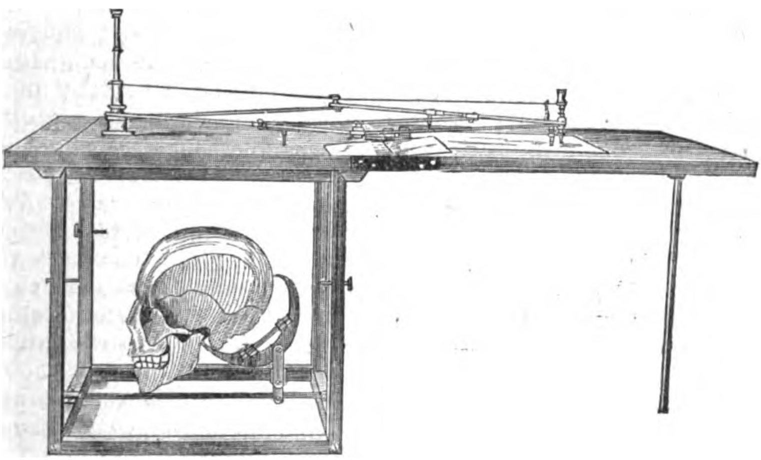
MICROSCOPY.[1]

THE DIOPTROGRAPH.[2] — The dioptrograph is a mechanical drawing apparatus adapted to drawing the outlines of macroscopic objects. It consists of a pantograph (in which the tracer is represented by a tubular diopter) supported on a square table.

[1] Edited by Dr. C. O. WHITMAN, Mus. Comparative Zoology, Cambridge, Mass.

[2] F. Kinkelin, Humboldt, I, Part 5.

By shifting the position of the diopter (sight vane) on a mirror glass plate, the eye can follow the outlines of the object placed below the glass as they appear at the intersection of the cross-wires contained in the diopter. The table is supported by four square wood frames which together bound a cubical area, as shown in the figure. A pane of glass, fitted with a frame, represents the upper surface of the cube, while the five other sides are open so as to admit of the frame with the plate being placed upon any side of the cube. On the lower frame Schroeder's steel pincers are fitted, by means of which the object may be placed in such a position as to be completely detached and visible from all sides. These pincers firmly grasp the object; this is effected by fastening a screw and by three sharp points. The axis of the pincers has a bilateral clamping movement, which may be regu-



lated by means of a screw; then there is a round bar fixed on two opposite sides of the lower frame, on which a vertical rotation of the axis of the pincers and a horizontal sliding movement of the object can take place. Lastly there is a conical pin, adjustable by means of a special screw and admitting of a horizontal rotation of the object. The drawing-board, which is connected with the table by means of hinges, can be folded down upon the glass plate of the table.

In the figure the pantograph, consisting of the diopter and pencil connected by a frame-work for mechanical adjustment, is represented in position for drawing. The drawings may be made of natural size, or they may be enlarged or reduced, according to the proportions required.

For the use of tourists a folding instrument is made. In this instrument objects are placed on three pins, which can be adjusted at the bottom according to requirements.

For the geometric drawing of smaller objects the following appliances are used:

1. One object-plate, which is placed below the glass plate and which, by means of an arm, may be moved up and down on one side of the cube. Upon this plate a small object imbedded in clay or any other suitable substance may be placed.

2. A tubular diopter furnished with a lens.

PRICES.

A. Folding dioptrograph of polished mahogany for tourists.......	$70 00
B. Same as A, but not polished and without case.................	55 00
C. Same as A, but not folding (like the figure here given)........	72 50
D. Same as C, not polished....................................	62 50

The instrument is made by Luckhardt & Alten, in Cassel, Germany.

OPALINA.[1]—The life-history of this very interesting parasitic protozoan, and the methods to be employed in tracing it are now very fully known, thanks to the investigations cited below. The subject is one of special interest to the teacher as well as to the investigator, since it illustrates one of the simplest life-cycles known to us, and since the mode of development and propagation rises somewhat higher than in typical unicellular Protozoa.

Habitat.—Hind-gut of batrachians (also found in planarians and Naideæ).

Period of reproduction.—Early spring, beginning as soon as the host leaves its winter quarters for the open water, and continuing only a few weeks in some species, while lasting for two to three months in others.

Mode of reproduction.—Longitudinal and transverse fission. The adult polynucleated Opalina (*O. caudata* and *O. similis* have generally two nuclei, and occasionally only one) splits up by successive divisions into a large number of parts, each containing, according to the species, one or more nuclei. These parts encyst while in the hind-gut of the host, and are then dropped with the fæces into the water. The spherical cysts (.025-.03^{mm}) remain unchanged for several weeks on the bottom, and only begin their development after being swallowed by young tadpoles and passing into the hind-gut.

Material.—The adult Opalina may be easily obtained by cutting out the hind-gut of a frog and pressing a little of the contents of

[1] Th. W. Engelmann. Ueber Entwickelung u. Fortpflanzung von Infusorien. Morph. Jahrb., I, p. 573, 1875.

Ernst Zeller. Untersuchungen über die Fortpflanzung und die Entwickelung der in unseren Batrachiern schmarotzenden Opalinen. Zeitschr. f. wiss. Zool., XXIX, p. 352, 1877.

Wilh. Pfitzner. Zur Kenntnis der Kerntheilung bei den Protozoen. Morph. Jahrb., XI, H. 3, p. 454, 1885.

Moritz Nussbaum. Ueber die Theilbarkeit der lebendigen Materie. Arch. f. Mik. Anat., XXVI, pp. 487, 509 and 514, Jan., 1886.

the anterior end into a drop of water on a slide. If this is done in early spring, all the phases of fissiparism may be obtained, together with encysted stages. The best time, however, for studying the process of fission is during the winter. If a frog is kept in a warm room twenty-four hours and fed well, it will be found that fission of the Opalinæ, if any are present, has advanced to the point of encysting, and a complete series of stages may be readily obtained.

Material for the study of the development is obtained from young tadpoles (5^{mm} and upwards in length) collected from their natural haunts, or better, raised from the egg and fed with Opalina cysts. A few hundred eggs of the frog may be placed in a small aquarium, and at the same time the fæces from several frogs which are known to contain numerous Opalina cysts. Soon after hatching, the tadpoles will begin to eat water plants and animal and vegetable remains of various sorts found on the bottom, and will thus become infected with Opalina cysts.

Methods of study.—(*A*) The process of reproduction by fission can be followed best by placing fresh specimens in a drop of a very dilute solution of gum arabic and examining without a cover-glass; or, in a drop of humor aqueus from the frog, in which Nussbaum kept them alive, in one case four days. The humor aqueus should be inclosed air-tight.

(*B*) For the study of the caryokinetic multiplication of nuclei, which is the leading feature in the development of multi-nucleate forms, preparations may be made in the following manner:

(1) Press out a portion of the fæces from the anterior end of the rectum on to a slide, adding a drop of water.

(2) Carefully remove, by the aid of fine forceps, all visible pieces of substance, taking special care to leave no grains of sand, and then cover with a very thin cover-slip. The water added should be just enough to fill the space beneath the cover without flowing beyond its edges, and the space as thin as possible in order that the larger Opalina may be under slight pressure.

(3) By means of a brush make a border of picric acid (saturated aqueous solution) all around the cover, and leave the slide thus prepared in a moist chamber for one or two days, giving time for the acid to penetrate slowly and evenly from all sides.

(4) Wash with distilled water until the Opalina are completely colorless, allowing the water to work slowly under from one side of the cover, while it is drawn away with blotting paper from the opposite side. Great care should be taken not to add the water more rapidly than it is drawn away, as the raising of the cover would allow the Opalinæ to float away. The process of washing requires several hours, and must be closely watched from beginning to end.

(5) Stain with Grenacher's alum carmine or hæmatoxylin, drawing a border of the dye around the cover, as was done with

picric acid; then leave in moist chamber for a few hours (hæmatoxylin), or one or more days (alum carmine).

(6) Wash with distilled water, proceeding as in No. 4.

(7) Dehydrate with absolute alcohol, taking care not to disturb the cover, and then add a border of clove oil. The alcohol soon evaporates and is replaced with the clarifying medium. The preparation is now ready for examination. If the preparation is to be preserved permanently the clove oil should be replaced by xylol, and then a thin solution of balsam in xylol allowed to flow under the cover as the xylol evaporates. As a good preparation is often spoiled in the process of mounting, it is well to make the examination in clove oil first.

——:o:——

SCIENTIFIC NEWS.

— Dr. C. V. Riley, entomologist of the Department of Agriculture and honorary curator of insects in the National Museum, has presented to the National Museum his extensive private collection of North American insects, representing the fruits of his labors in collecting and study for over twenty-five years. His collection contains over 20,000 species, represented by over 115,000 pinned specimens, and much additional material preserved in alcohol or other methods. It is estimated by those familiar with the collection to have a money value of at least $25,000. In addition to the actual cost of material it is hard to estimate the amount of time and labor that such a collection represents. In acknowledging the donation, Professor Baird expresses the warmest appreciation for this most generous gift, and his assurance that both now and in the future it will afford a valuable means of study for the entomologists of this country. This collection is especially rich in Coleoptera and Lepidoptera, and the latter contains many rare larvæ, blown and in alcohol. As it stands, by this gift the entomological collections of the National Museum become next in importance to those at Cambridge.

— The anniversary meeting of the Royal Microscopical Society was held in January, when the president (Dr. Dallinger, F.R.S.) delivered an address dealing with the results he had obtained during the last four years principally in the employment of the greatly improved microscope object-glasses made on the homogeneous-immersion principle. The special research which Dr. Dallinger has been engaged upon, and to which his address was devoted, is the elucidation of the origin, development, division and ultimate function of the nucleus, as found in what may be assumed to be its simplest condition in the more striking of the septic organisms, and his microscopical observations have been chiefly made on the living organism. The object-glasses employed by Dr. Dallinger are high powers of most recent construction, in which the apertures have been carried to the highest point hitherto attained, and were made expressly for his investigations by Messrs. Powell and Lealand.

— The first number of the Bulletin of the Scientific Laboratories of Denison University, at Granville, Ohio, edited by Professor C. L. Herrick, contains the following articles:

Osteology of the evening grosbeak (*Hesperiphona vespertina* Bonap.), with Plate I and frontispiece, by the editor.
Metamorphosis of phyllopod Crustacea, with Plates V–VIII and Plate X, by the editor.
Superposed buds, with Plate XII, by Aug. F. Foerste, class of '87.
Limicole, or mud-living Crustacea, with Plate IX, by the editor.
Rotifers of America, Part I, with descriptions of a new genus and several new species, with Plates II–IV and Plate X, by the editor.
The Clinton group of Ohio, with descrip'ions of new species, with Plates XIII and XIV, by Aug. F. Foerste.
A compend of laboratory manipulation, Chapter I, Lithological manipulation, accompanied by a condensed translation of Eugene Hussak's Tables for the determination of rock-forming minerals, by the editor.

The whole forms a volume of 180 pages, with fifteen plates, and affords good evidence of the scientific zeal and energy of the scientific corps of this institution.

— At a recent meeting of the Royal Society, Dr. Downes read a paper on the action of sunlight on micro-organisms, in which he called attention to the fact that the observations made by himself and Mr. T. Blunt, described in papers contributed to the society during 1877–79, had been corroborated by other investigators. Dr. Downes now asserts that the hyperoxidation of protoplasm by sunlight is a general law, from the action of which living organisms are shielded by protective developments of cell wall, coloring matter, &c. In previous communications Dr. Downes had shown that sunlight was fatal to saprophytes, and that in the presence of free oxygen the molecule of oxalic acid might, under the influence of light, be entirely resolved into water and carbonic acid. The alterative ferment of cane sugar, a representative of the diastases, is also oxidized by sunlight.—*English Mechanic.*

— *A question.*—I should be very much obliged to anybody for some information on the following points, regarding Menopoma, Amphiuma, Necturus and Siren:

1. Where are these batrachians common?
2. Has anybody ever seen the eggs and larvæ (embryos) of these forms, and in what season?—*Dr. G. Baur, Yale College Museum, New Haven, Conn.*

— Mr. Mellard Reade's presidential address to the Liverpool Geological Society has been printed in separate form, and will interest geologists. He discusses the way in which the enormous amount of mineral matter poured into the Atlantic is distributed. He concludes that deposits thousands of feet in thickness are being laid down about the mouths of great rivers, forming extensions of the true deltas, and, therefore, what appears to be a submarine prolongation of the margin of a continent may, in many cases, be merely a sedimentary deposit washed down from the interior.

— Dr. Alfredo Dugés writes from Guanajuato, Mexico, that on the 5th of February there fell at that place eight inches of snow. It made a fine appearance, covering the trees full of leaves, and stupefied the inhabitants, most of whom had never seen such a phenomenon. The thermometer fell to 4° and 5° C.

— Jan. 17, died in Strassburg, Professor E. Oscar Schmidt, who was distinguished for his researches on turbellarian worms and sponges, as well as several valuable general works.

— W. T. Thiselton Dyer has succeeded Sir Joseph Hooker as director of Kew gardens.

——:o:——

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Biological Society of Washington, Feb. 20.—Mr. Romyn Hitchcock, Demonstration of the resolving power of a new 1–16 inch objective; Dr. D. E. Salmon and Dr. Th. Smith, On a new method of producing immunity from contagious diseases; Dr. C. V. Riley, A carnivorous butterfly larva; Mr. Lester F. Ward, The plane tree and its ancestors; Dr. C. Hart Merriam, Contributions to North American mammalogy. II. Description of a new species of Aplodontia; Dr. George Vasey, New and recent species of North American grasses.

New York Academy of Sciences.—I. A new electric winding apparatus for clocks (illustrated); II. On the need of a normal time-system for observatories, Professor John K. Rees.

March 1.—Mrs. Alice D. Le Plongeon read an address on Yucatan, its ancient temples and palaces. The paper was illustrated with numerous lantern photographs, taken by Dr. and Madame Le Plongeon, during twelve years of study and exploration among the remarkable monuments and scenery of Yucatan.

Boston Society of Natural History, Feb. 17.—Dr. W. G. Farlow spoke of the collection of lichens recently presented to the society by Charles J. Sprague, Esq.,; and Mr. S. H. Scudder discussed the best methods for arranging and classifying the libraries of natural history institutions.

March 3.—Dr. Thomas Dwight read a paper on the significance of the internal structure of bone, illustrated by the stereopticon.

Appalachian Mountain Club, Feb. 10.—An ascent of the Matterhorn, by Melancthon M. Hurd; The Carter-Moriah path and camp, by W. G. Nowell; An exploration of the Pilot range, by W. H. Peck.

Feb. 17.—Major Jed. Hotchkiss addressed the club on Mount Rogers, the highest point of the Appalachians in Virginia.

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THE

AMERICAN NATURALIST.

VOL. XX.—*MAY*, 1886.—No. 5.

THE LIMITS OF ORGANIC EVOLUTION.

BY H. W. CONN, PH.D.

THE theory of evolution implies a past, a present and a future. Since the time of Darwin the past and present of the organic world have been studied with the result of showing that the history has been one of evolution. Having now reached this conclusion, and having discovered many of the laws of advancement in living nature, we are getting into a position where we may begin to study the future. It is the object of this paper to indicate certain limits in development toward which the organic world have long been tending.

The idea of evolution implies that there has been a gradual rise in the scale of organisms from the lowest to the highest. But when palæontologists have attempted to show this gradual rise by a study of fossils they have had much less success than the theory of evolution would lead us to expect. That there has been a general advance from the earliest fossils in the Silurian until now, seems unquestionable. But instead of being the most palpable result of study, this advance is so obscure as to cause surprise to all who have attempted to make it out in detail. Darwin expressed his surprise at the lack of evidence, and the difficulties have increased rather than decreased since he wrote. In some groups there has been an undoubted advance; the vertebrates, for instance, showing this in a marked manner. In a majority of groups, however, we do not find it, for while the animals have not in any case remained absolutely stationary, the development, as a rule, has consisted chiefly in the increase and diversity of species and genera. It is a matter of continual surprise to naturalists to find constantly increasing evidence of the great diversity of life which must have existed in the Silurian era. With the advance of our knowledge of these earliest fossiliferous rocks, new groups are constantly being added to the already extensive fauna. Our knowledge of these times is still very scanty, but even now we know that the fauna was highly developed. All of the subkingdoms of the animal world were represented, about five-sixths of the orders and suborders of the present time, many families and a few genera. Bearing in mind the necessary incompleteness of our collections, we must conclude that this fauna contained representatives of a large proportion of the animals now existing. Nor were the various groups represented by these lowest types simply. The Cœlenterata contained Hydrozoa and Actinozoa; among echinoderms we find echinoids; among mollusks we find cephalopods; among Arthropoda were Tracheata in the shape of scorpions. And while these types were not developed as highly as they are now, their mere existence is enough to indicate that already a large advance in the evolution had taken place. If this is the case it becomes plain that evolution since that time has been almost entirely confined to the elaboration of the groups then existing.

Now we are not at liberty to assume an indefinite amount of time prior to the Silurian. Of course it is impossible to say just how long a time elapsed between the origin of life and the Silurian, but it seems hardly possible that it could have equaled the time since then. But upon evolutionary theories the animal kingdom must have developed during that period from the lowest unicellular condition to the complex and diverse fauna of the Silurian. When we consider, therefore, that during this time all of the important groups of the animal kingdom* arose, and that none have arisen since that time, it becomes quite evident that evolution must have progressed with greater rapidity at that time than it has since. This conclusion is no new one, for many naturalists have seen the necessity of making some such assumption. It will, indeed, be generally acknowledged that evolution at earlier times was more rapid than at present.

Now it follows as a direct result of this fact that the evolution of organisms is approaching an end, and that it will eventually cease. If the rapidity of evolution as a whole has been decreasing since the beginning of life, it is evident that unless something

*[It is very doubtful whether there were any Vertebrata during the Silurian.—*Ed.*]

occurs to begin the process over again, evolution must eventually cease.

This would lead us to the conception of the animal kingdom as not unlimited in the extent of its development, but as having a definite end. This may be made clearer by two comparisons. First, consider the life of any individual. This begins with the fertilization of the ovum. Fertilization seems to endow the ovum with a large amount of vitality, or what has been called growth force. This growth force causes the ovum to begin to divide and grow with great rapidity, and the changes which take place as the result of this invigoration, are very great during the early part of the development. But immediately from the first the rapidity of this growth begins to decrease. As the individual becomes older its rate of growth becomes less and less, the invigorating force gradually expending itself, until finally a condition is reached where no further growth takes place. For some time now the animal remains in a state of equilibrium, but finally begins to go down hill and dies. A better comparison still may be found in the life of a tree. Here also we find at the outset a rapid growth and advance, very early the rapidly growing stems give rise to buds which are to become the great branches of the coming tree, and in a very short time the shape of the tree is determined by the growth. All of the larger branches have appeared, and they have already given rise to many of the smaller ones. But here also the rate of growth diminishes, and as the tree becomes older and larger it grows less rapidly. Finally at a certain size its growth practically stops. It does not of course actually cease to grow. It is continually producing new leaves, new twigs; old branches are being in some places expanded, in others they are dying and disappearing. There is thus a constant change and growth taking place in the various parts, but the growth of the tree as a whole has ceased. For a long time, perhaps the tree may remain in this condition, but little by little the process of decay encroaches upon that of growth, and finally the tree dies.

These examples are of course simple analogies, and it is a question how far they may be regarded as applying to the animal kingdom as a whole; but there are many facts which indicate that the history of the organic world as a whole is parallel to the life of the individual, in part at least. That the relations of animals in the world are to be looked upon as that expressed by a branching tree is now perfectly demonstrated. That all of the great branches of this tree, as well as many of the smaller ones, had made their appearance at the time of our first record of life, is also proved. That evolution since that time has consisted chiefly in the elaboration of these branches by increasing their division and the diversity of species and small groups, is becoming more and more evident. That there has been a slowing up of development in recent times is a fact which is strongly forcing itself upon naturalists; and the conclusion has found expression in the statements sometimes made that no new species are arising to-day, or that the present is a period of comparative rest. The same general principle is taught from embryology, for very early in their history do embryos become separated into the subkingdoms to which they belong, while more and more slowly does the separation into the smaller groups take place. All of these facts together strongly indicate that the illustrations used above are in part real illustrations, and that the whole animal kingdom must be looked upon as an individual starting its history with a vigorous growth which is gradually expending itself. Whether or not this growth will reach a limit, and whether or not it will eventually cease so that the animal kingdom will disappear, it is our purpose to consider.

That the organic world is approaching a limit to its development is a conclusion which does not depend upon any vague idea of growth force for its support; for a little thought upon discovered laws will clearly show us that there must be a limit to advance. The best definition which has ever been given of the grade of structure of animals is the degree to which differentiation of organs is carried. Evolution as it tends to raise the grade of animals is constantly increasing the amount of differentiation. A distinction must be made, however, between differentiation and specialization. Evolution sometimes results in retrogression, and in these cases differentiation becomes less rather than greater. Evolution does not, therefore, always produce a greater differentiation, but in all cases, even in those of retrograde development, it does produce a specialization of parts, and we may rightly regard evolution in the animal kingdom as a process of specialization. Now it is plain that this process can not go on forever. A low undifferentiated unspecialized organism has an infinite possibility in its lines of specialization. A simple spherical mass of cells, the supposed common ancestor of the animal kingdom, may be modified in a very great variety of directions, each of which may give rise to a different type of animal. This possibility lies in the fact that it is as yet undifferentiated and unspecialized. But just as soon as it does become modified in any one direction the possibilities decrease. Some of the descendants of this ancestor becoming vertebrates are forever precluded from becoming anything else; others becoming mollusks must remain mollusks forever, with all of their descendants. And as later descendants become further modified in any direction into definite types, the chance for future modification becomes rapidly less. It is only the absolutely undifferentiated which has infinite possibilities, for as soon as a single step is taken in any direction they become finite. Now it is plain, since evolution does not retrace its steps, that with every step in advance the possible lines of development become less and less. All the descendants of the vertebrate line must conform to the vertebrate type. The vertebrate becomes separated into fish, reptile and mammal, and the individual of each group is still further fettered in its development by the special line which its ancestors have taken. The descendants of the animals which have started the order of birds can not take any new line. They can develop to perfection this type, but there they must stop. And so on, with every advanced step the possibilities of expansion are constantly decreasing.[1]

Now a continued specialization of this sort is sure to reach a limit eventually, it must run to extremes and then stop. Development must reach a position where further advance is no longer possible. Let us illustrate this principle by a concrete example. A five-toed appendage is an unspecialized form which we may conceive as modified in many directions. It may become a grasping organ or a supporting organ or a swimming organ, etc. In the group to which our ruminants belong this appendage has become a supporting structure. In this same group there has further been a tendency to rise upon the toes, in such a manner that instead of walking on the soles of the feet and palms of the hands, the animals in question walk more and more upon the fingers and toes. When this peculiarity first began to manifest itself, the mammals had five toes. As it became more and more

[1] This idea can be found fully expressed in the writings of Professor Cope.

marked the shorter toes were little by little lifted from the ground and became of little or no use. In successive ages we find the shorter toes becoming smaller while the middle toe becomes larger. This line of specialization has continued until it has reached a limit in the horse, which has lost all but one toe on each foot, and walks on the extreme tip of this toe. Now it is perfectly evident that a limit has been reached in this case. The horse may perhaps in the future lose the rudimentary splint bones which still remain, but he can not lose his last toe; and it is therefore impossible to conceive any further development of the horse in this direction. Now the same principle will apply to all other lines of specialization, although we may not always be able to see what this limit may be. Physical laws would of themselves set limits to every line of advance, even if there be no such limits determined by the organism itself.

It is easy to find examples which will show that such has been the general history of groups in the past. Some have reached the extreme of their development in the distant past, and have ceased to advance or disappeared. Others seem even now to be at the summit of their advance, and others still are yet advancing. The line of development represented by the trilobites has completely exhausted itself. It rapidly approached its limits even in the Silurian, and then began to dwindle away and has disappeared completely. The brachiopods had also at this time reached their point of highest specialization, and became a highly developed group even at this early age. Since then they have remained stationary as to their organization, having steadily decreased in numbers, and the few that are left show no advance over the Silurian forms. The cephalopod mollusks gradually increased in complexity during the Palæozoic, and finally a limit of the shelled forms was reached in the ammonites of the Jurassic and Cretaceous. The culmination was followed by extinction. Meantime a second line of development began, that of the naked cephalopods, and this has gone on advancing until the present time. The decapod Crustacea represent a group which is even now near its culmination. From their first appearance in the Carboniferous there has been a tendency toward concentration of organs toward the head. As this specialization advanced the abdomen became smaller while the head region became larger. Finally in the crabs, which appeared in the Jurassic, everything was concentrated into the head region; the abdomen being little more than a rudiment. Evidently we are here near a limit, and we may look upon the crabs of to-day as the culmination of the special line of development which has characterized this line of animals. The vertebrates in general have been continually advancing during geological times with a continued increase in specialization and in multitude of types. But even here there has been the same story of limitation. The ganoids culminated in the Devonian, and have advanced no farther. One great line of reptiles reached its limit in the Jurassic. And so everywhere. The study of every group teaches that the past history has been a gradual specialization, which approaches a limit. In many cases in the past this limit has been reached and advance ceases; while in others animals are still on their road toward it.

It is plain, therefore, that the evolution of the whole animal kingdom is slowly but inevitably approaching an end. With every advance in differentiation the possible lines of development decrease, and since the actual lines followed are tending to run themselves out, the whole must eventually stop.

Recognizing, then, that there must be a limit to advance, we must next ask the question, whether after this limit is reached the animal kingdom will become extinct; whether, like an individual, it will die of old age? And here we must distinguish two questions. First, is it not possible that animals which have remained unspecialized during all times, should give rise constantly to new lines of development, and thus be a perpetual source of new forms? Second, will the present groups, after reaching their culmination, become extinct or simply remain stationary?

That there is a theoretical possibility of the origin of new types cannot be denied. New types, *i. e.*, new lines for specialization, can arise only from undifferentiated forms. But such undifferentiated forms still exist in great numbers. Even the most unspecialized form of all, the unicellular animals, are abundant enough, and in all groups we are acquainted with more or less generalized types. Theoretically, then, there is no reason why any of these forms should not expand itself and thus form an eternal source of new world forms. So long as the unspecialized forms do not become extinct, we cannot deny the possibility of an infinite number of future subkingdoms, which would, of course, make the animal kingdom an example of never-ending evolution.

But all of our evidence indicates that such a future is probably not a practical possibility, even though, as far as we can see, it may be a theoretical one. All biological studies point strongly to the conclusion that instead of several points of origin the animal kingdom has had only one. The subkingdoms have not arisen independently from the Protozoa, but have all had a common ancestor, the gastrula, and this means that only once has the unicellular form given rise to important lines of multicellular descendants. Though the Cœlenterata stand very near this primitive unspecialized form, there is no evidence that it has the power of further differentiation; but on the contrary, all tends to show that whatsoever differentiation of this simple type ever did take place, to give rise to the subkingdoms, occurred before the Silurian. Since palæontology shows us that no new great types have arisen since the Silurian, it is plain that all of the expansion of the simple unicellular form must have taken place before the Silurian. And coming through the later ages we find evidence the same in its tenor. The conclusion everywhere seems to be that when a generalized form has given rise to one or two lines of development, it either disappears or loses its power to originate new forms. Every step of palæontology carrying existing groups farther and farther back in the geological ages adds force to this general conclusion. Every bit of evidence which indicates a fundamental unity of the animal kingdom testifies to the same. Without questioning the theoretical possibility that any or all of the existing more or less unspecialized forms may in the future develop, we must acknowledge that the probability is against it. Nothing in history indicates that these groups retain power to expand, and there is, therefore, no reason for thinking it a possibility in the future. Remembering what a large number of groups we are learning to trace back to the Silurian, remembering that development has consisted, in the later geological ages, simply in the expansion of groups appearing long before, we must conclude that the power of the undifferentiated forms to expand into different lines of development disappears very early in their history. While then we cannot deny the possibility of an indefinite future development from the existing generalized types, it is certainly improbable that any new great groups will arise. Man, seizing upon the last undifferentiated faculty, the intellect, is developing this to extreme, and will probably be the last type to appear.

The second question, concerning the probability of the various groups becoming extinct after reaching their culmination, is not so easy to answer. It is certainly possible to conceive of them as remaining stationary at their culmination, neither developing further nor becoming extinct. Undoubtedly the history of the past shows that after any group reaches an extreme of specialization it does not remain stationary, but begins to decrease in numbers, finally to disappear. But the number of groups which have thus become extinct is not very great, and it is a question whether it is justifiable to claim that they really represent a general tendency. It is certain that disturbing causes which have acted in the past to produce extinction will grow less and less in the future. We can see that extinction in the past has been due to the inability of these extreme forms to adapt themselves to new circumstances with sufficient readiness. Of course when all of our present groups shall have developed themselves to extremes, they too will be unable to adapt themselves to new conditions, and would doubtless become extinct if they were called upon to meet adverse circumstances. But it is an acknowledged fact that physical changes are much less rapid now than they were formerly, and that they are constantly diminishing. If this is the case the developed extremes of the future will not be called upon to meet such changes in condition as those which have induced extinction in the past; and they may even then be able to undergo such slight modifications as will enable them to meet the slight changes in condition. Moreover, in the past extinctions have very generally occurred because animals have been unable to contend with the new and more vigorous forms which were capable of a more rapid modification than the older ones. But as we have seen, the number of possible new forms is constantly decreasing, and the time must come when it is no longer possible for new forms to arise to crowd the older ones out of existence. With almost stationary physical conditions, and with no new rivals, it may be that the animal kingdom is approaching a condition when, for reasons which we have seen, it cannot advance, and when there will be nothing to cause extinction, and it will therefore remain stationary.

There is one new condition, however, which is to have a prodigious influence upon the evolution of the future. The influence of man on the animal kingdom cannot be computed, but it is probable that in many respects it will be a death blow to its evolution. Man is rapidly causing the extinction of almost all land animals, at least the larger ones. As the frontiers of civilization are being extended further and further into the uninhabited regions, he is driving out of existence all of the larger animals and many of the smaller ones. We have only to look ahead a comparatively short time to see the extinction of all land animals except such as man may preserve for his own use. To what extent this may apply to other animals, to insects, marine animals, etc., is not clear. But in the highest group of animals, the vertebrates, it is pretty clear that man is eventually to bring about not only the end of advance, but also the practical extermination of all animals except such as he especially preserves.

With all of these considerations together it seems perfectly plain that we must look upon the evolution of the animal kingdom as definitely limited and approaching an end. The tendency of specialization to advance to extreme limits, the impossibility of the further adaptation of these extremes to new conditions, the significant fact that no new forms of importance have arisen during all the later geological ages, the great influence of man in causing extermination of all sorts of animals, all these point to the same end. Just as evolution began in time, so it will end in time, and we must look upon the animal kingdom as progressing toward a limit. When this limit is reached, either there will follow a gradual extinction through a diminution of vital power, or if this be not the result, a stationary condition will ensue in which such animals as man has left in existence will remain unmodified until the progress of physical changes makes this world no longer habitable.

ANCIENT ROCK INSCRIPTIONS IN EASTERN DAKOTA.

BY T. H. LEWIS.

ON the celebrated map of I. N. Nicollet, of the "Hydrographical basin of the Upper Mississippi river," published by the U. S. Government in 1845, appear, for the first time, two strange names in Eastern Dakota, not far from the sources of the Minnesota river. The first is *Wakiyan Hurpi* (or thunder's—not lightning's—nest), placed about thirteen miles north-west of the foot of Lake Travers; and the other is *Wakiyan Oye*, a few miles west of the head of the same lake. The route followed by Nicollet, however, did not pass by either place, so he must have put them down from the general description of his guides, as he makes no mention of them in his text. It is of the latter locality, well known by its translated equivalent of "Thunder Bird's Track"—on account of the incised rocks there—that this article treats; together with another rock of like kind in the neighborhood.

In the month of August, 1883, I was engaged in the survey of the sepulchral tumuli, forts and other earth-works of Big Stone and Travers lakes, and thus being brought into the vicinity of the rocks in question, took the opportunity afforded of making careful tracings of the pictographs they showed, considering them of much archæological interest. These tracings have been reduced by pantograph to one-eighth the size of the originals, and drawings thus made from them accompany this short account of the "track rocks."

The first diagram shows the pictographs constituting "Thunder Bird's Track," as they are engraved on an irregular shaped rock located some six miles west and a little north of the village of Brown's Valley, Minnesota, and within the limits of the Sisseton and Wahpeton reservation of Dakota Territory. The rock lies on the summit of a hill which commands a good view of the country, though there are other hills in the vicinity which have a greater altitude. It is about three and a half feet in diameter, and the characters are grooved in its surface to about one-fourth of an inch in depth. The grooves are, for the most part, very smooth. It will be seen, however, that these figures do not make very good bird-tracks, and I think that they more probably represent human hands. For convenience of reference the separate characters are numbered on the diagram, and may be thus described.

1 and 2. Represent hands placed in different positions.

3. Shows two hands in combination.

4. Is of a nondescript shape.

5 and 6. Are undoubtedly meant for hands, as their outlines can be imitated in shadow on the wall by placing one's own hands in the proper positions.

7. Is another nondescript, though a portion of it represents a hand.

The other rock is known as "Thunder Bird's Track's Brother"—that is, a brother to the "track"—and is situated about two miles east of his elder, on the slope of a terrace bordering the valley of the Minnesota river. As will be seen on comparison, the diagrams illustrating the two rocks are entirely distinct from each other in respect to the shapes of the characters, and by no means bear out the close relationship between the localities implied by the names the Indians have given them.

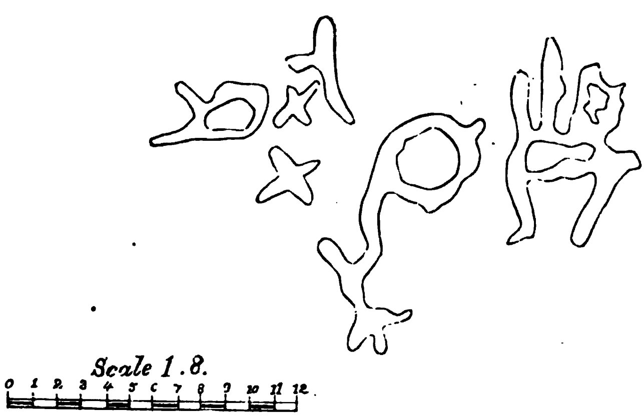
The inscriptions on both rocks are apparently very ancient, and it is extremely doubtful whether the present Indians or their immediate predecessors (the Cheyennes ?) had anything to do with carving them.

I made inquiry as to any traditions that might be current among the Dakota Indians on the reserve concerning these rocks, and obtained certain mythological information now concisely stated.

Thunder Bird is said to have had his nest on a high mound, which was composed of sticks and brush, and was situated some ten miles north-west of the foot of Lake Travers, in the center of a deep wide gorge. One day there was a great storm which flooded the whole country. Thunder Bird, in his anger at having been driven from his nest by the rising waters, flew away and alighted on this rock—*Wakiyan Oye*—which was the only place not covered by water, and left the impression of his feet there.

On subsequently looking for printed records of this tradition, the first account I could find of it was in the shape of a short poem from the pen of an Indian trader of 1823, W. J. Snelling (son of the military officer after whom Fort Snelling was named), Thunder Bird's Tracks.

Thunder Bird's Tracks' Brother.



Ancient Rock Inscriptions in Eastern Dakota.

which appeared in Griswold's Poets and Poetry of America (1842), and has been reprinted in Mr. Neill's histories. The last stanza but one has direct reference to the rock I have here first described, and runs thus:

> "Not long upon this mountain height
> The first and worst of storms abode,
> For, moving in his fearful might,
> Abroad the God-begotten strode.
> Afar, on yonder faint blue mound,
> In the horizon's utmost bound,
> At the first stride his foot he set;
> The jarring world confessed the shock.
> Stranger! the track of Thunder yet
> Remains upon the living rock."

———:o:———

VARIATION OF WATER IN TREES AND SHRUBS.

BY D. P. PENHALLOW.

THE amount of water which highly lignified plants contain, particularly as influenced by season and condition of growth, obviously bears a more or less important relation to physiological processes incident to growth, and most conspicuously to those which embrace the movement of sap. Studies relating to the mechanical movement of sap in early spring at once suggest the question as to how far this is correlated to greater hydration of the tissues at the time when this movement is strongest. It was with a view to exhibiting this relation more clearly, that determinations of moisture in a large number of woods, representing growth of one and also of ten years, collected at different seasons, were made in 1874.[1] The range of seasons was not as complete as could have been desired, and no attempt was made to formulate a general law applicable to this question. With a view to extension of data in this direction, additional estimates were undertaken in 1882, and it is the object of the present paper to combine all the results thus obtained, together with such other facts

[1] W. S. Clark. Agriculture of Massachusetts, p. 289.

as have come to our notice, and see how far they indicate a general law.

Theoretical considerations lead us to infer that if there is any variation at all, the hydration of structure must be greatest during the period of active growth, and least during the period of rest. How far this is supported by the facts will appear in what follows.

Hydration of Dead Wood.

Incidentally to the main question, specimens of dead wood, deprived of the bark and representing an age of from four to eight years, were collected and the moisture determined. While the branches were dead, none of them were in an advanced state of decay, so that the contained water could not be regarded as that of active decomposition, but simply that which would be readily retained in the lifeless, air-dried substance as exposed on the tree. The results obtained from fifteen species of trees showed an extreme variation of 6.1 per cent, the range being from 12.9 per cent to 19.0 per cent of water. The mean hydration obtained from these determinations was 15.1 per cent. The results appear in the following table:

HYDRATION OF DEAD WOOD.

Determined at 100° C.

Species.	*Per cent of water.*
Acer saccharinum	18.8
Amelanchier canadensis	19.0
Betula alba	15.1
" lutea	15.9
" lenta	13.7
Carpinus americana	13.8
Castanea vesca	14.0
Cydonia vulgaris	12.9
Cornus sericea	13.6
Pinus strobus	11.9
Pyrus malus	12.9
Prunus serotina	17.4
Quercus alba	15.5
Tsuga canadensis	18.6
Ulmus americana	13.5
Mean	15.1

Hydration of Wood from Living Trees.

The specimens upon which the principal facts in this paper are based, were collected as sections of living branches, representing on the one hand growth of two years, and on the other hand the growth of four years. For the obvious reason that the bark could not be properly separated from the wood with any degree of uniformity, it was left on in every case, so that in all the determinations here given the results show the combined percentage of water in wood and bark. Obviously this gives a result which differs materially from that which would be obtained if the wood and bark were considered separately. Also, while care was taken not to collect specimens in which the dead bark was strongly developed, thus securing as great uniformity as possible, the very fact that the bark was present, as well as the certainty of its variability in structural character, and thus also in hydration, as collected even from the same species at different seasons, rendered certain variations in the results unavoidable. This will doubtless appear upon examination of specific cases, but error from this source is reduced to a minimum in the aggregate, so that the mean results, in view of all the precautions taken, may doubtless be accepted as correct.

From an examination of the following results it will appear that, comparing the young growth with the older wood, the percentage of water is sometimes greater in one, sometimes greater in the other, conforming to structural peculiarities of the species and the relative preponderance of more or less strongly hydrated tissue. The mean results, however, clearly show what we might infer upon theoretical grounds, viz., that in the youngest growth, as also in the sap wood, the percentage of water is higher by two per cent than in the older growth, where the heart wood is in relative excess. This is found to hold true in the mean results not only for each season but also for all seasons; in the former case, however, the disproportion showing a variation from 0.8 per cent to 3.3 per cent.

	February.		March.		April.		September.		December.		Means.
	1st year.	2d year.	1st year.	2d year.	1st year.	2d year.	1st year.	2d year.	1st year.	2d year.	
Magnoliaceæ.											
Liriodendron tulipifera L.		55.8	52.7	54.9						59.3	44.5
Tiliaceæ.											
Tilia americana L.	55.1	53.9		55.6			48.6	55.9	53.2	58.1	54.3
Rutaceæ.											
Ailanthus glandulosus Desf.	48.6	46.0									47.3
Anacardiaceæ.											
Rhus glabra L.			45.6	41.1					41.2	36.4	41.1
" typhina L.			51.3								51.3
Vitaceæ.											
Vitis cordifolia Michx.	42.1	41.7	48.3	48.0					48.8	43.7	45.4
Ampelopsis quinquefolia Michx			59.2	60.7					76.4	62.4	64.6
Ilicineæ.											
Ilex verticillata Gray			46.2	46.4					48.0	49.4	47.5
Celastraceæ.											
Celastrus scandens L.			47.7	49.4					52.3	52.4	50.4
Rhamnaceæ.											
Ceanothus americana L.			17.3	37.6					19.5	41.4	28.9
Sapindaceæ.											
Acer saccharinum Wang.	46.5	47.1	47.5	42.9			48.1	44.0	42.6	42.7	45.2
" rubrum L.	44.9	44.7	50.8	45.4		48.7			53.0	55.1	48.9

Æsculus hippocastanum L.	49.1	46.1									47.6
" flava Ait.							64.9	65.4			65.1
Leguminosæ.											
Gleditschia triacanthus L.	34.9										34.9
Robinia pseudacacia L.			44.0	38.3					51.3		44.5
Rosaceæ.											
Amygdalus persica L.	46.1	40.4	50.9	49.4	56.0	43.7			55.3	42.0	47.9
Prunus domestica L.			48.1	41.2					53.9	46.2	47.4
" serotina Ehrhart			52.7	50.8			50.6	50.3	47.3	46.0	49.6
" cerasus L.			49.9						50.6	47.7	49.4
Cydonia vulgaris L.	45.5	39.6					56.3	52.6			48.5
Pyrus communis L.	49.9	47.7	49.7	48.1	55.4	54.0	54.0	51.5	53.7	50.0	51.4
" malus L.	49.5	44.8	45.7	41.5	49.0	46.4	56.2	54.5	48.3	59.	48.8
Amelanchier canadensis Torr. & Gray	44.3	38.0		44.6					47.4	45.1	45.9
Cratægus tomentosa L.			43.1	40.4					55.9	43.4	45.7
Hamamelaceæ.											
Hamamelis virginica L.	41.7	41.1	48.2	54.2					48.7	51.3	44.2
Cornaceæ.											
Cornus florida L.			55.1	43.2					53.6	52.8	51.2
" sericea L.			50.6	49.2			55.4		51.2		51.6
Nyssa multiflora Wang.	50.9	49.0	48.0	49.3			51.1	50.9	50.8	58.7	52.2
Caprifoliaceæ.											
Sambucus canadensis L.			58.2	48.2					56.3	55.1	54.4
" pubens Michx.	54.5	55.7									55.1
Viburnum opulus L.	44.7	47.7									46.2
Rubiaceæ.											
Cephalanthus occidentalis L.			54.1	42.8					42.8		46.6
Ericaceæ.											
Andromeda ligustrina Michx.			46.7	45.9					38.0	59.0	47.4
Kalmia latifolia L.		42.5	50.7	44.4					49.4	42.3	45.8
Azalea nudiflora L.			41.8	43.8					45.8	49.9	45.3

	February.		*March.*		*April.*		*September.*		*December.*		*Means.*
	1st year.	2d year.	1s year.	2d year.	1st year.	2d year.	1st year.	2d year.	1st year.	2d year.	
Oleaceæ.											
Fraxinus americana L.	32.0	29.6	38.3	34.4					35.2	29.5	33.2
Thymeleaceæ.											
Dirca palustris L.	51.8										51.8
Lauraceæ.											
Sassafras officinalis Nees.	34.9	33.9	40.7	38.1						41.4	37.8
Solanaceæ.											
Lycium barbarum L.									65.4	58.0	61.7
Urticaceæ.											
Ulmus fulva Michx			52.1	44.0					51.5	36.3	45.9
" americana L.	41.4	39.8	45.6	36.8			57.1	52.3	43.0	43.9	44.9
Morus alba L.	52.1	43.0									47.5
" rubra L.			47.0	42.8					56.2	40.9	46.7
Platanaceæ.											
Platanus occidentalis L.	44.5	57.6	50.2	52.1	52.5	53.8			48.2	50.6	51.2
Juglandaceæ.											
Juglans nigra L.	45.5	46.1	50.2	56.1					50.6	53.8	50.4
" cinerea L.			50.5	52.2			54.2	54.1	49.5	50.4	51.8
Carya alba Nutt.			39.2	40.2			45.7	45.1	38.4	37.8	41.1
" porcina Nutt.			40.8	38.0					38.1	35.4	38.1
" amara Nutt.	33.3	31.2									32.3

Cupuliferæ.											
Quercus alba L.	38.0	35.2	40.6	38.7	41.2	36.7	43.1	39.5	45.0	41.9	39.9
" bicolor Willd.			45.0						46.9		45.9
" coccinea v. tinctoria Wang.			42.5	38.0					44.9	39.3	41.2
" ilicifolia Wang.			40.6	39.4					42.2	38.4	40.4
" palustris Du Roi.			43.2	39.8					44.8	39.9	41.9
" prinus v. monticola Michx.			42.4	37.9					42.4		40.9
" rubra L.		34.3	42.6	38.6					41.7	39.9	39.4
Castanea vesca L.			47.4	45.6					45.1	44.5	45.6
Fagus ferruginea Ait.	44.2	44.7	45.4	45.7					45.2	45.8	45.2
" sylvatica v. purpurea.			43.8	43.3					43.7	43.5	43.5
Corylus americana Walt.			49.8	48.6					50.9	52.8	50.5
Ostrya virginica Willd.	37.6	38.6	43.0	36.5					44.4	44.5	40.8
Carpinus americana Michx.	38.7	39.4	45.6	42.8			51.7	48.7	44.5	43.9	44.4
Myricaceæ.											
Comptonia asplenifolia Ait.	40.6	40.0									40.3
Betulaceæ.											
Betula lenta L.			44.9	38.9					44.7	41.5	42.5
" lutea Michx.	42.4	43.6		38.2			49.7	49.4	44.4	42.5	44.5
" alba v. populifolia Spach.	46.2	42.0	41.1	37.7			53.9	48.5	45.0	39.1	44.4
Alnus viridis D.C.			47.9	43.2					48.9	55.0	48.8
" incana Willd.	50.4	51.5									50.9
Salicaceæ.											
Salix alba v. vittelina L.	49.9	51.7	55.5	55.5			53.1	49.7	55.4	55.5	53.3
Populus tremuloides Michx.	49.8	50.9	47.9	52.5			53.3	51.0	52.8	51.5	51.2
Coniferæ.											
Larix europea L.	40.9	47.8									44.3
Juniperus virginiana L.			57.6	45.9					56.2	45.1	51.2
Tsuga canadensis Carriére	48.7	49.6	46.8	49.9					44.1	45.6	47.4
Pinus rigida Miller.			54.2	52.3					53.8	57.6	54.5
" strobus L.			58.8	52.1	56.3	55.5	62.9	58.3	63.1	51.6	57.2

If we next inquire into the relation which seasons bear to the contained water, we will observe that the percentage continually rises from the mid-winter period until spring, and that it again falls from the close of summer to the mid-winter period. The extreme variations, as exhibited in our figures, show between February and September a difference of 8.4 per cent for the youngest growth and 7.1 per cent for that which is older.

MEAN HYDRATION OF WOODS.

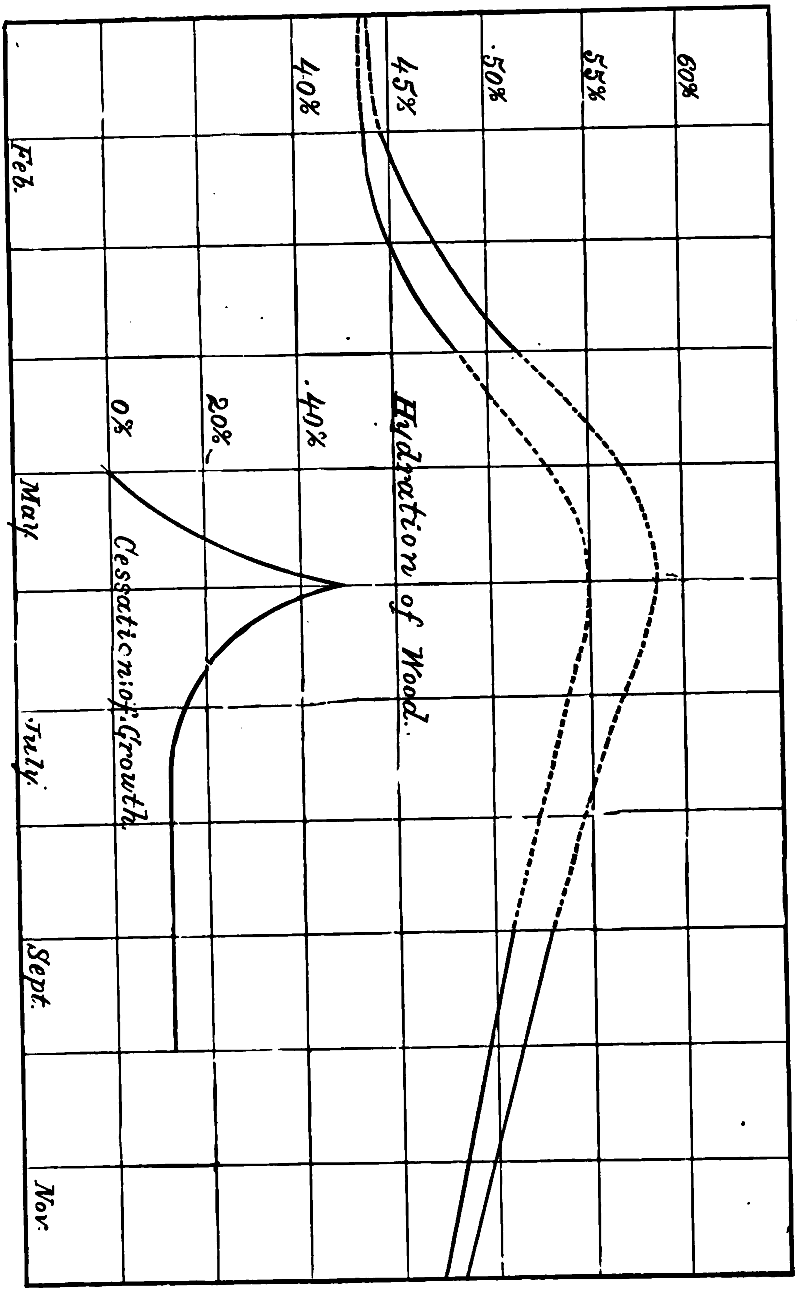
Determined at 100° C.

Months.	*Per cent water.*		*No. for average.*	
	1st year.	2d year.	1st year.	2d year.
February	44.7	43.9	37	38
March	47.2	44.8	59	60
April	51.7	48.4	6	7
September	53.1	51.0	19	18
December	48.3	47.2	61	58
	49.0	47.1	36.4	36.2

Our figures also indicate that the maximum hydration of the tissues must occur either in September, or at some period intermediate to this month and April. By graphic representation of these results, it will become possible to determine with approximate accuracy the true period at which this maximum is reached. The figures show that from February to April, the rate of percentage increase is much more rapid than the rate of percentage decrease from September to December, showing that the maximum must fall nearer the former than the latter period.

A properly constructed curve will show all of these relations. By reference to the accompanying diagrams it will be seen that the curves for both young and old wood run nearly parallel, but that they tend to approach at their greatest depression, or the mid-winter period, and to more widely separate at their greatest altitude, during the spring period. It is also seen that from mid-winter to spring, the curve rises rapidly, and reaches its greatest elevation about the last of May for the young wood, that which is older possibly reaching its maximum a few days later. From this time on the curve descends at a more gradual rate until December, when it suddenly drops to its minimum depression, which evidently occurs in January.

PLATE XVII.


60%
55%
50%
45%
40%
Feb.
May
July
Sept.
Nov.
0%
20%
40%
Hydration of Wood.
Cessation of Growth.

PERIODS FOR CESSATION OF GROWTH.

As upon theoretical grounds the tissues contain most water when the growth is most active, data which will enable us to accurately fix the limiting periods for the season's growth, will have an important bearing upon this question. Mr. W. E. Stone,[1] accepting the completion of terminal buds as marking completion of the longitudinal growth for the entire year, has obtained the following data as establishing the limiting periods of growth for the latitude of West Point, N. Y., 41° 23′ N.:

JUNE 1ST.

Acer saccharinum Wang.
" *rubrum* L.
Amelanchier canadensis Torr. & Gray.
Carya alba Nutt.
Fagus ferruginea Ait.
Fraxinns americana L.
Hamamelis virginica L.
Kalmia latifolia L.
Populus tremuloides Michx.
Quercus alba L.
" *bicolor* Willd.
" *coccinea* Wang.
" *prinus* v. *monticola* Michx.
Sambucus pubens Michx.
Tilia americana L.
Ulmus americana L.
" *fulva* Michx.

JUNE 15TH.

Betula lenta L.
Carpinus americana Michx.
Castanea vesca L.
Juglans nigra L.
Lindera benzoin Meissn.
Morus rubra L.
Ostrya virginica Willd.
Prunus cerasus L.

JULY 19TH.

Andromeda ligustrina Muhl.
Alnus incana Willd.
Nyssa multiflora Wang.
Staphylea trifolia L.

INDETERMINATE PERIOD.

Ampelopsis quinquifolia Michx.
Celastrus scandens L.
Rhus sp.—
Vitis sp.—

Growth in length having ceased at these periods, the energy of the plant then becomes directed to the lignification of tissues and the deposition of reserve material for growth the following year. These changes, however, of necessity involve a continual decrease in the contained water. The data above also show that the majority of plants complete their longitudinal growth within the first six weeks of the growing season; that most of these complete their growth in from three to four weeks; and that, as the season advances, the number of plants still growing, rapidly diminishes until the middle of July, after which time there are left but few, those being plants like the grape, which continue to grow until arrested by severe cold.

[1] Bull. Torrey Bot. Club, XII, 8, 83.

A graphic representation of these changes in connection with the curves of hydration, will enable us to determine the relation of growth and seasons to hydration of tissues. This comparison will show most conspicuously that that period at which growth for the season is chiefly terminated, is nearly coincident with the period of maximum tissue hydration, the former being but five or ten days later than the latter.

From the foregoing facts the following appear to be the general laws:

1st. The hydration of woody plants is not constant for all seasons, and depends upon conditions of growth.

2d. The hydration reaches its maximum during the latter part of May or early June, and its minimum during the month of January.

3d. Hydration is greatest in the sap wood; least in that which is older.

4th. Greatest hydration is directly correlated to most active growth of the plant; lignification and storage of starch and other products being correlated to diminishing hydration.

These facts apply only to latitudes lying between New York and Boston. For other latitudes, certain modifications might be necessary.

——:o:——

DOMESTICATION OF THE GRIZZLY BEAR.

BY JOHN DEAN CATON, LL.D.

THE family of bears is among the most widely distributed groups of the quadrupeds, and is represented by a number of living species. They occupy the polar regions of the north and the temperate and torrid regions of both hemispheres. Some are of enormous strength and fierceness, others are diminutive and comparatively mild in disposition. Nearly every species has been held in captivity in considerable numbers, yet of their adaptability to domestication but little of real scientific value has been written, and I think I may add but little is known, for the want of judicious experiment and careful observation.

They are sometimes met with in the streets in various countries, exhibited by street showmen, who have taught them various amusing tricks, evincing considerable intelligence and docility, but these are generally of the smaller and milder species, and but little of their training or domestication has been recorded.

Those which have been exhibited in gardens or menageries, as a general rule, are merely held in confinement, and not in domestication, so that little can be learned from them of their adaptability to complete subjection to human control. This can only be learned by long-continued experiments and observations under favorable circumstances by those whose tastes and inclinations fit them for the task.

My attention was called to this subject by reading the "Adventures of James C. Adams," who was a celebrated hunter of California, who seems to have had a genius for capturing and domesticating wild animals. Among others he fairly domesticated quite a number of the grizzly bear (*Ursus ferox* Lewis and Clark) with complete success. This is the largest and fiercest known of all the species, and it might be expected the most intractable or unsubmissive to human control, yet such appears not to have been the case.

The first specimens experimented with were two cubs, over a year old when caught, taken in Washington Territory, between Lewis and Clark's fork of the Columbia. They were brother and sister; the latter was retained by Adams, and his experiments were principally conducted on her, which he called " Lady Washington." She seems to have been the more tractable and submissive. The male he parted with to a friend, after he had received but the rudiments of his education. At first they were chained to trees near the camp-fire, and resisted all attempts at familiarity and kindness; then severity was adopted, until they finally submitted.

Soon after the male was parted with, and we have no account of his subsequent career. The female was always after treated with the utmost kindness, and in a few months became as tractable as a dog. She followed her master in his hunting excursions, fought for him with other grizzlies, and saved him from the greatest perils.

She slept at his feet around the camp-fire, and took the place of a most vigilant watch-dog. He taught her to carry burdens with the docility of a mule, and as she grew up her great strength enabled her to render him great assistance in this way.

Another bear of the same species he captured in the Sierras in

California, before its eyes were open, and raised it on a grayhound bitch in company with her own pup. This he called Ben Franklin, and proved more docile even than the first. He never found it necessary to confine in any way this specimen, but he was allowed to roam and hunt with his foster brother, the grayhound. They were inseparable companions, and seemed to have as much affection for each other as if they had been of the same species. Before he was full-grown, when his master was attacked by a wounded grizzly, he joined in the fight with such ferocity as to save his master's life, and though he was severely wounded in this contest, with careful nursing he survived, and ever after showed as much courage in attacking his own species as if he had not met with this severe punishment.

He seems to have had less confidence in Lady Washington, for she was generally kept chained during the night and when on the journey, though allowed to follow free when on the hunt. This may be explained by the fact that she was over a year old when captured, while the other never had any taste of wild life.

When she was chained up near the camp-fire in the Rocky mountains, she was visited several nights by a large wild bear, which her master refused to disturb, and she, in due time, bore a cub, which grew to maturity under the tuition of her owner, and which he called Fremont, which he says manifested considerable intelligence and sagacity, but not equal to that of his dam or to his favorite, Ben Franklin. It is to be regretted that exact dates are not given from which we can determine precisely the period of gestation, but by comparing all the dates that are given, it may be stated provisionally that that period was nine months.

It has been stated by good authority that no instance has been known of any member of the bear family having bred in domestication, and this is the only instance where I have found such an event recorded or heard it stated.

Our author raised many of these animals, but generally disposed of them before they reached maturity, but he gives us no particulars except in these two instances.

He found the black bear, when raised in camp, as readily domesticated as the grizzly, and as fond of his society, following him about the camp and through the woods with fidelity and attachment.

It is certainly interesting to observe how completely the savage nature of these ferocious animals was overcome in those which were born in a wild state, and it would be interesting to know what modifications might be made in succeeding generations by domestication, an experiment which could only be successfully tried under favorable conditions, which do not exist with the great number of animals of this genus now held in confinement. I may remark here a wide difference in the effect of domestication upon the disposition of this animal and many others, which in the wild state show no ferocity, but only timidity. Take the Cervidæ, for instance, when brought up by hand; they lose all fear of man; they develop a wickedness and ferocity never manifested in the wild state; while the bears, so terrible when untamed, show docility, constancy and affection when brought into close familiarity with man. They seem to appreciate his kindness and care, and repay it with attachment and devotion, while the other class of animals, which are not ferocious by nature, seem to be entirely unappreciative of kindness, or at least seem incapable of continued personal attachment to the hand that feeds them.

When I first read Mr. Adams' adventures, I considered it an interesting romance, or at least that it was largely embellished by an ingenious imagination, but upon inquiry in San Francisco, I met reliable persons, who had known him well, and had seen him passing through the streets of that city, followed by a troop of these monstrous grizzly bears unrestrained, which paid not the least attention to the yelping dogs and crowds of children which closely followed them, giving the most conclusive proof of the perfect docility of the animals. Indeed, they were so well trained that they obeyed implicitly their master's every word or gesture in the midst of a crowded city, with surroundings which we might suppose would have aroused their native ferocity, if that were possible. After the most careful investigation I became convinced of the reliability of the narrative, and as the facts our author gives are interesting to science, I venture to repeat them, regretting, however, that he did not appreciate the great value of his observations, since he might have given us more particulars which must have come under his observation; but so it is that a vast majority of those who have good opportunities for observing do not know how to observe judiciously, or do not record their observations.

Mr. A. S. Kent, of San Rafael, California, who for many years, on account of his health, spent several months each year in camp life in the mountains, principally hunting the deer, informed me that he once purchased a couple of cubs of the grizzly bear, which he took into camp with him. One of these proved very docile and tractable, and seemed fond of his attention and society, and usually slept contentedly at his feet. The other seemed possessed of a much more vicious disposition, and he was obliged to kill it. Possibly this might have been overcome by patient care and judicious training.

There is no doubt that different dispositions among these animals as among most other, may be met with.

Mr. Kent's observations tend, in some degree at least, to confirm those of Mr. Adams.

May we not hope that some one with the necessary taste and proper facilities will try experiments and give us the benefit of their observations?

A complete monograph of any one of our species of bears under all conditions would be a valuable addition to our zoölogical literature.

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ON THE NATURE AND ORIGIN OF THE SO-CALLED "SPIRAL THREAD" OF TRACHEÆ.

BY A. S. PACKARD.

WHILE we owe to Professor O. Bütschli the discovery of the mode of origin and morphology of the tracheæ, which as he has shewn[1] arise by invaginations of the ectoblast; there being originally a single layer of epiblastic cells concerned in the formation of the tracheæ; we are indebted to Professor A. Weismann[2] for the discovery of the mode of origin of the "intima," from the epiblastic layer of cells forming the primitive foundation of the tracheal structure. We are also indebted to Weismann for the discovery of the mode of origin of the terminal tracheal cells.

Weismann did not observe the earliest steps in the process of formation of the stigma and main trunk of the tracheæ, which Bütschli afterwards clearly described and figured.

Weismann, however, thus describes the mode of development

[1] Zur Entwicklungsgeschichte der Biene. Zeit. wissen. Zoologie, XX, 519, 1870.
[2] Die Entwicklung der Dipteren im Ei. Zeit. wissen. Zoologie, XIII, 1863.

of the intima; after describing the cells destined to form the peritoneal membrane, he says: "The lumen is filled with a clear fluid and already shows a definite border in a slight thickening of the cell-wall next to it.

"Very soon this thickening forms a thin structureless intima, which passes as a delicate double line along the cells, and shows its dependence on the cells by a sort of adherence to the rounded sides of the cells (Taf. VII, 97 A, *a b c*). Throughout the mass, as the intima thickens, the cells lose their independence, their walls pressing together and coalescing, and soon the considerably enlarged hollow cylinder of the intima is surrounded by a homogeneous layer of a tissue, whose origin from cells is recognized only by the regular position of the rounded nuclei (Taf. VII, fig. 97 B).

"Then as soon as the wavy bands of the intima entirely disappear and it forms a straight cylindrical tube, a fine pale cross striation becomes noticeable (VII, 97, B, *int*), which forms the well-known 'spiral thread,' a structure which, as Leydig has shown, possesses no independence, but arises merely from a partial thickening of the originally homogeneous intima.

"Meyer's idea that the spiral threads are fissures in the intima produced by the entrance of air is disproved by the fact that the spiral threads are present long before the air enters. Hence the correctness of Leydig's view, based on the histological structure of the tracheæ, is confirmed by the embryological development, and the old idea of three membranes, which both Meyer and Milne-Edwards maintain, must be given up."

Weismann also contends that the elastic membrane bearing the "spiral thread" is in no sense a primary membrane, not corresponding histologically to a cellular membrane. On the contrary, the "peritoneal membrane comprises the primary element of the trachea; it is nowhere absent, but envelops the smallest branches as well as the largest trunks, only varying in thickness, which in the embryo and the young larva of Musca stands in relation to the thickness of the lumen."

The trachea, then, consists primarily of an epithelial layer, the "peritoneal membrane" or the invaginated epiblast; from this layer an intima is secreted, just as the skin or cuticle is secreted by the hypodermis. We may call the peritoneal membrane the *ectotrachea*, the intima or inner layer derived from the ectotrachea the *endotrachea;* we hope to show that the so-called "spiral thread" is not spiral in arrangement but simply thickenings of the endotracheal membrane, parallel to each other, not necessarily continuous nor arranged in a spiral manner. For these chitinous bands we would suggest the name *tænidia* (Greek, little bands).

Our observations have been made on the larva of a species of *Datana*, which was placed in alcohol, just before pupation, when the larva was in a semi-pupal condition, and the larval skin could be readily stripped off. At this time the ectotrachea of the larva had undergone histolysis, nothing remaining but the molted endotrachea, represented by the tænidia, which lay loosely within the cavity of the trachea. The ectotrachea or peritoneal membrane of the pupa was meanwhile in process of formation; the nuclear origin of the tænidia was very apparent, and it was their appearance which led me to examine the origin and mode of development of the so-called "spiral thread," and to endeavor to trace its relations to the intima (endotrachea) and peritoneal membrane (ectotrachea).

Fig. 1 is a longitudinal section through a secondary tracheal branch, showing the origin of the circular chitinous bands, or tænidia. At *t'* are pieces of six tænidia which have been molted; *ectr* are the nuclei forming the outer cellular layer, the ectotrachea or peritoneal membrane. These nuclei send long slender prolongations around the inside of the peritoneal membrane; these prolongations, as may be seen by the figure, become the tænidia. The tænidia, being closely approximate, grow together more or less, and a thin endotracheal membrane is thus produced, of which the tænidia are the thickened band-like portions. The endotracheal membrane is thus derived from the ectotrachea, or

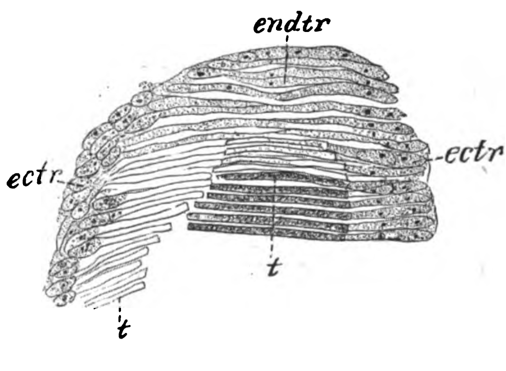

FIG. 1.—Longitudinal section of a trachea, showing the origin of the tænidia or so-called spiral thread.

primitive tracheal membrane, and the so-called "spiral thread" is formed by parallel thickenings of the nuclei composing the secondary layer of nuclei, and which become filled with the chitin secreted by these elongated nuclei. The middle portion of the tænidia, immediately after the molt, is clear and transparent, with obscure minute granules, while the nuclear base of the cell is filled as usual with abundant granules, and contain a distinct nucleolus.

The origin of the tænidia is also well shown by Fig. 2, which is likewise a longitudinal section of a trachea at the point of origin of a branch. The peritracheal membrane or ectotrachea (*ectr*) is composed of large granulated nuclei; and within are the more transparent endotracheal cells; at *t'* are fragments of the molted tænidia. The new tænidia are in process of development at *t;* at base they are seen to be granulated nuclei, with often a distinct nucleolus, and sending a long slender, transparent, pointed process along the inside of the trachea. These unite to form the chitinous bands or so-called spiral threads.

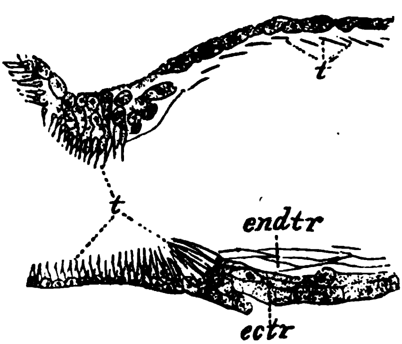

FIG. 2. Origin of the tænidia.

The tænidia I have found to be separate, independent, solid rings, more or less parallel and independent of each other. The supposed spiral arrangement I believe to be an optical illusion. The tænidia of a main branch stop at the origin of the smaller branches, and a new set begin at the origin of each branch. This fact also shows conclusively that the chitinous bands are not spiral. Nor do the tænidia at the origin of the branch pass entirely around the inside of the peritoneal membrane; in the axils they are short, separate, spindle-shaped bands.

The tænidia are usually thin, flat, but often slightly concavo-convex, the hollow looking towards the center of the trachea. I have been unable to find any forming incomplete hollow rings or tubules, like the pseudotrachea of the fly's tongue figured and described by Professor G. Macloskie.[1] It seems to me that the function of the tænidia is like that of the cartilaginous rings of the tracheæ of vertebrates, *i. e*, to keep the air-passage open so that the air may pass to the cells at the end of the trachea. All the figures of the spiral thread hitherto published I believe to be incorrect. In Guyon's work on *Pulex penetrans* they are represented to form a loose spiral, and so they appear at first glance under a low power in the tracheæ of the common flea of the cat. But on close examination, in an excellent preparation, the so-called spiral thread is a series of independent parallel tænidia, the spaces between them being wider than usual. In Fig. 3, from a prepa-

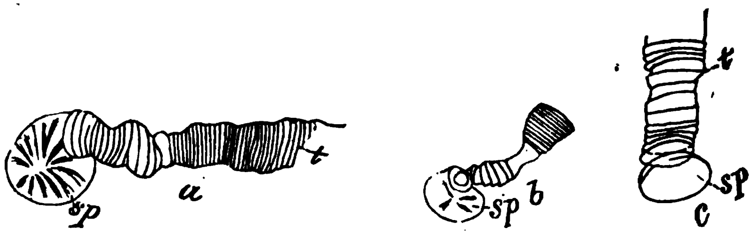

FIG. 3.—Stigma and trachea of Pulex.

ration kindly presented to me by Mr. Justin Spaulding, *a* represents one of the first abdominal spiracles and the trachea arising from it; *b* the fifth; and *c* one of the last abdominal spiracles and its trachea. When the trachea bends or contracts in diameter the tænidia become less parallel, and a spiral appearance is produced. In the last pair the tænidia are remote from each other.

In a preparation of one set of the salivary glands from the head of the honey bee, given me by Mr. Spaulding, the common duct is much like a trachea, having similar tænidia, and here they are observed to be parallel, independent bands.

The sections of Datana were made for me by Professor H. C. Bumpus of Olivet College.

[1] Thus far I find myself unable to agree with Professor G. Macloskie that the "spirals of the proper tracheæ" are "crenulated thickenings of the intima," or that the tænidia are really tubular. In his valuable and suggestive article, "The Structure of the Tracheæ of Insects (AMER. NAT., XVIII, 567), I believe he has demonstrated the true nature of the pseudotracheæ of the fly. His criticisms of Chun's views and figures I believe, in the main, to be correct, but thus far I am unable to convince myself that the "external fissure" of the tænidia in the figure he copies from Chun, whose original essay I possess, is really such; it appears to be a new tænidium in process of formation previous to molting.

EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

—— In our issue of June of last year we referred to certain conditions of membership of the National Academy of Sciences in the following terms: "In the interval between the annual meetings of 1884 and '85 two members of a committee appointed to investigate a question affecting one of the bureaus of which they themselves are employees, were requested to resign from the committee by the chief of the bureau in question. This was in obedience to a rule that a department of the Government can not be criticized by its subordinates. It requires no argument to show that if this rule be carried out with reference to the Academy of Sciences, its usefulness as an independent body is at an end. There is also another danger which flows directly from the same or a similar attitude on the part of heads of bureaus. These gentlemen by filling up the academy with their employees can obtain practical control of its decisions. This would be immensely convenient to them under various circumstances, but it would introduce an element of corruption into the academy from which it has been hitherto happily free, and which would deprive it of the respect and confidence of the country."

In the case first cited the bureau's action would indicate an apprehension of hostile criticism, perhaps judging from the characters of its employees who had been appointed to investigate. In the latter case reference was made to a case where the bureau concerned did not ask its employees to resign, since it evidently did not fear any adverse report as a result of their investigation. In this case some of the members of the committee appointed by the president of the academy to coöperate with the committee of Congress in the investigation of the scientific bureaus, were employed by some of the bureaus at high salaries. There are a good many men who, under such circumstances, would be unable to perceive any necessity for changes in the administration of their bureaus.

The position of the academy in relation to these matters although at present unavoidable, is, to say the least of it, unfortunate. And the situation of its members is reduced to utter helplessness in consideration of the manner in which committees are appointed and are permitted to report. That is, they are appointed in the interval of the academy's meetings by the president alone, and make their reports without the supervision or criticism of the academy, which only hears of them at the next meeting as a matter of history! The academy is thus made responsible for any report that a committee of paid employees of a department may choose to make respecting that bureau. The situation is such that no member of the academy can wish it to continue. The reflections which the world can justly make on its position ought not to be possible.

As a remedy for this fundamental evil, we propose the following changes in the constitution of the academy:

1. Not more than one-half of the members of the National Academy shall be paid employees of the Government.

2. The president of the academy shall be selected from those members who are not paid employees of the Government.

3. Committees selected to report on the efficiency of a Government bureau, shall not embrace any employees of that bureau.

4. The committees shall be selected by the president and council, which shall also approve the reports of committees before they are sent to Congress.

5. The members of the council who are not such *ex officio*, shall be selected from the different classes of the academy as follows: One from the anthropological class; two from the biological; two from the physical; and one from the applied class.

6. For convenience of reference and selection the membership of the academy shall be divided into four classes as follows: Anthropology, embracing philosophy, pure mathematics and anthropology in the limited sense; Biology, including the biological sciences and psychology; Physics, including astronomy, physics, chemistry and geology, without palæontology; and Applied science. The proportion of membership of each should be .15 p. c., .35 p. c., .35 p. c., and .15 p. c.

7. In order that the members of the academy shall be more or less independent of Government places, they should be salaried; $1000 per annum for members; $1500 for members of the council, and $5000 for the president.—*C.*

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RECENT LITERATURE.

The Annals of the Cakchiquels.[1]—The Cakchiquel tribe of Indians forms one of the more interesting portions of the Maya stock of Central America; their territory extends at present from Lake Atitlan, Southern Guatemala, to the east and thence to the south down to the Pacific. The ruins of their former center and

[1] *The Annals of the Cakchiquels.* The original text, with a translation, notes and introduction. By Daniel G. Brinton, M.D. Philadelphia, 1885, 8vo, vi and 234 pages. (Forms No. 6 of the editor's Library of Aboriginal Literature.)

capital, Iximché, are situated in the Department of Chimaltenango. Owing to their agricultural pursuits, to the healthy climate and the consequent density of population, these Indians, as well as some other Maya nations, developed a higher culture, material and mental, than many other neighboring populations of Southern Mexico, Honduras, etc. Many tracts of Guatemala contain sculptures and architectural remains of these gifted tribes, attesting no mean degree of civilization, and this they must have acquired by slow progress long before the Spanish conquest. Under the Spanish domination several of the more enlightened Indians applied themselves to gathering and writing down the legends and historic traditions of the people, moved by patriotism and by the desire of preserving their national antiquities. One of these monuments is the Popul Vuh, written in Kiché; another is the book now before us, worded in Cakchiquel, a dialect differing from Kiché about as much as Spanish does from Portuguese. The manuscript was called by Brasseur de Bourbourg, "Mémorial de Tecpan Atitlan," but Dr. Brinton has substituted the more appropriate title, "Annals of the Cakchiquels." The original forms a volume of forty-eight leaves or ninety-six pages, intended to figure as a document in a lawsuit to reobtain or secure landed property belonging to the ancient family of tribal rulers, the Xahila. This legal instrument included in its plea the full history of the tribe and the genealogy of the Xahila family, to make their claim more valid, and it had several members of that family for its authors. They wrote it in Atitlan in the course of the sixteenth century, and only the historic or first portion of it is printed in the volume before us. The precious manuscript became the property of the late Abbé Brasseur, and with his collection finally passed into the hands of Mr. Alphonse L. Pinart, who loaned it to Dr. Brinton for publication. Assisted by natives the learned Abbé had made a tentative French translation of the document, and in perfecting it he was materially aided by the then extant Spanish translations of some select portions. The document is authentic and of high ethnographic value. Let us now examine how Dr. Brinton has acquitted himself of the task of editing, translating and commenting it.

The missionary, F. de la Parra, who died in 1560, introduced into the Cakchiquel alphabet five un-Spanish letters or signs to represent certain "cut" sounds[1] of that dialect. These occur also in the Xahila manuscript; Brinton reproduces four of them, rendering the fifth by *tz*. These bold, black-faced characters no doubt impart to the book an air of erudition; but Dr. Stoll in his grammatic sketch of Cakchiquel replaced them by apostrophed consonants, and Dr. Brinton might have done the same. At any rate it is puzzling to see that they do not appear also in the proper names of the English translation opposite. One of these

[1] Sounds followed by a short stop of the voice.

letters, the *cuatrillo*, Brinton often transcribes by *q*, but when he should write *Baqahola* he writes *Bagahola* (p. 67).

Cakchiquel never became a literary language in our sense of the term, and consequently its orthography was never regulated by anything like steady principles. In the "Annals" the orthography is about as unsettled as can be. Now in editing texts of this description, the first thing to do is to adopt scientific principles deduced from and consistent with the character of the language; to introduce a correct, logical punctuation, to separate the prefixed pronouns from their verbs or nouns, *if separable*, to make compound words conspicuous as such *at sight*, and to unite the tense and modal signs with the verb into one word. *On the lower margin the editor has to indicate all the readings of the original for which he introduces emendations*, according to his system, *into the text*. Of a similar proceeding Brinton has no conception whatever, for he reproduces the most flagrant incongruenties, which every school-boy might easily correct, in his text. Thus he writes: qui bi, and in other places quibi, *their names* (p. 66), chu kahibal and chukahibal, *at the setting* (p. 68), Iximche and Yximchee (name of the capital, with the old-fashioned Spanish *y* for *i*, p. 166), qari instead of qa ri, *and they* (p. 68), and many other instances sufficient to perplex the student. Besides this, Brinton has also "doctored" the manuscript by introducing text-readings of his own, for in the introduction (p.63) he says: "I felt myself free to exercise in the printed page nearly the same freedom which I find in the manuscript." He did so, undoubtedly, not only in the Indian text, but also in French quotations from Brasseur, in which he shows himself fearfully at variance with the accepted French accentuation: p. 197, and still more on p. 206. On p. 206 the term *l'œuvre* is twice written *l'euvre*. Neither has the proof-reading been thoroughly attended to; p. 168 we find Yaxontik, and in the translation Yaxonkik; p. 107, Vookaok, a proper name, which is spelt voo kaok on p. 110; p. 66, mahaniok, *before;* in the vocabulary the same term is spelt mahanick.

After all this we are not much surprised at the punctuation of the Indian text, for where there is, and ought to be, a period in the translation, Brinton often has a comma or *nothing at all* in the text. On p. 66 paragraph third is subdivided into 1, 1, 0, where he has 1, 2, 3 in the translation. It takes just as much time to study Brinton's "system" of editing and, as he calls it, his "freedom in the printed page," as it does to acquire the whole of the Cakchiquel language, which cannot by any means be called a very difficult one.

While professing to disagree in many passages with the Abbé's translation, the merits of which he otherwise fully acknowledges, the editor sometimes attempts a better one, and gives his motives for doing so in the Notes, pp. 195–208. Being thus bent on correcting, he nevertheless renders ixkaqahol (p. 67 and often) by *oh my children*, when the correct sense is: *you our children.* On pp. 176, 177 he omits in the translation the whole sentence: *tok xbokotah chiqa el Qeche vinak* (§ 145), because he could not find in his dictionaries the original form of the verb xbokotah. Likewise are omitted from the translation opposite the words rahpop achi Ig'ich, *and the counselor Ig'ich.* No gap or empty space was left in the translation to remind the reader of an omission, as fairness would have prompted every common-sense editor to do; neither do Brinton's "Notes" give notice of any omission having been made consciously. Students confiding *in the translation alone* might thus get cheated out of very important facts stated in the Indian original. It would be interesting to find out whether Brinton made any such "omissions" from the original also; in that case passages would be left out in the text as well as in the translation.

In comparing the small compass of the vocabulary contained in pp. 209–227 with the bulky text, which holds not less than sixty pages, our curiosity becomes aroused to some degree. For how could the large number of terms composing the texts become enclosed within so small limits, although there is a separate index for proper names? Further examination easily reveals the fact, that vuo-o, voo, *five*, a numeral often occurring in the text, is *not* in the vocabulary; ahauh, *ruler*, is there, but the verb *to rule*, of which xahauar (p. 87) is a conjugational form, is not there; we fail to find there: petebal, navipe, onohel, g'anel (the name of a *month*) of the text; for *pa* the definition *from* is omitted, though referred to in the "Notes." Tok is probably the same as tak, though we get no information on this point; g'ana (p. 68), though translated by *glorious*, is not recorded. The different forms of one word produced by alternation of sounds are referred to in a few instances only. In view of this neglect to enter *all the words* of the text into the collection, which Brinton was bound to do, we understand why he used the term *vocabulary* and not the otherwise more appropriate term *glossary* to designate it.

For the comprehension of a text in a foreign language we naturally have to enlighten ourselves on its grammatic elements. Suppose a reader gets hold of the "Annals" in some remote corner of Russia or India and wishes to study them not from the botchy translation only, but from the text itself, he finds no chapter on the grammar of Cakchiquel in the volume, except on phonetics, but is referred by Brinton to the Grammar "which he has for sale." The chief elements of inflection at least should be contained in the book, as prefixes, suffixes, verbal inflection, word-composition, etc. Of all this we find incidental notices in the "Notes," but nothing that could serve for grammatic guidance. Brinton's above-mentioned "Grammar" consists of two old grammars united into one volume, one of the seventeenth and the other of the eighteenth century. They will prove of help to students, undoubtedly, but of what help they will be, can be gathered from a remark of Dr. Otto Stoll, who studied the tongue on the spot. He states (Zur Ethnographie Guatemalas, p. 139), that Cakchiquel possesses three tenses only, and that the three or four others given by the Spanish missionaries do not exist, but were "squeezed out" of the natives by the application of Latin models. The verb lok' (p. 146) which supplied paradigms to the unfortunate grammatic attempts of the Padres to conjugate *amare, to love*, does not signify *to love* at all, but *to purchase*. The verb *to prize, to hold dear, to esteem*, is not, as falsely quoted by Brinton (p. 216), lok', but lok'oj (Stoll, p. 147). Or did the language change as much as that within the last two hundred years?

In the Introduction, p. 9, the editor states that the three Maya nations more closely related to the Cakchiquels: the Quichés, the Tzutuhils and the Akahals "dwelt respectively to the west, the south and the east of the Cakchiquels." Had he looked up the matter in Stoll's map and in the map of the Grammar *published by himself*, he would have noticed that the Kichés lived, and still live, upon a much larger territorial extent, north, west and partly south of the Cakchiquels, and that the Tzutuhils are enclosed on all except the western side by Cakchiquel settlements.

In the long list above, the mistakes and shortcomings were quoted from a *few* pages of the book only, and readers may decide for themselves how numerous the errors may be for the other nineteen twentieths of the volume. It was edited on false principles, and here as elsewhere the editor was too much in a hurry to appear before the public. Books like these require the prolonged, discriminating and plodding work of a mind concentrated upon itself. To render this text of use to science, Mr. Pinart, proprietor of the original and himself a linguistic scholar educated at German universities, should republish the chronicle and the still wanting *family record* after scientific principles, adding a correct and full translation and a complete glossary together with a variety of grammatic and ethnologic notes forming a *commentarius perpetuus*. This is the only way to do justice to this important document, now so piteously "doctored up" by the rudest kind of malpractice.—*A. S. G.*

Report of the New York Agricultural Experiment Station.[1]—It does not speak well for the kind of work generally done upon the agricultural experiment stations of this country that readers of scientific journals do not expect to find in them reviews of the annually published reports. Agriculture has been cursed by a greater amount of very poor work under the name of exper-

[1] *Fourth Annual Report of the Board of Control of the New York Agricultural Experiment Station for the year 1885.* With the reports of the director and officers. Transmitted to the Legislature January, 1886. Rochester, N. Y., E. R. Andrews, printer and bookbinder, 1886.

imentation than any other of the great industries. Dealing as it does with the soil, the atmosphere, plants and animals, one would suppose that careful and expensive experiments would invariably be confided to men trained in one or more of the great modern sciences—chemistry, physics, botany, zoölogy, geology, meteorology. That such has, however, not been the case, is shown by an examination of the reports which have appeared with more or less regularity ever since the agricultural colleges and agricultural departments of the State universities were organized. With here and there an exception, such reports have contained nothing which were of any value to a scientific investigator in any field whatsoever.

The report of the New York Agricultural Experiment Station for the year 1885 is noteworthy in several ways, not the least important of which is its early appearance, the copy under review having reached us early in February. Its contents are full of valuable matter covering nearly the whole field of agriculture in its widest sense. We can take time here for but a hasty glance at a few of the more important topics.

The results of duplicate plantings (p. 37) are suggestive. In the case of Indian corn differences in yields equivalent to from two to fourteen and fifteen bushels per acre were obtained from similar plats treated in the same way. Of similar significance are many of the duplicate germinations of seeds (p. 54).

In the germination of seeds to determine the influence of age (p. 58), much greater quantities were taken than is customary, the usual number here being some hundreds, often reaching several thousands. Results obtained in this way are much more satisfactory. The same precautions enter into the temperature experiments upon germinations of Indian corn (p. 64), and in the latter case some very useful results have already been reached.

Of a very different nature, but still of high scientific interest, are the following, viz., a study of maize, being an attempt at forming a new variety (p. 73); variations [of Indian corn] from seed (p. 74); the characteristics of wheat varieties (p. 90), being a systematic classification and arrangement of many varieties; improvement in selecting (p. 107), a bit of work such as Darwin delighted in; a description of the principal varieties of lettuce (p. 137), a systematic classification and arrangement; observations on growth, character and depth of roots p. 233).

The botanist's report (pp. 241–265) deals with pear blight, the spotting of quince fruit, the rotting of tomatoes, lettuce-rust, lettuce-mildew, the rotting of cherries and plums, the disease of the clover-leaf weevil, weeds and their fungous parasites. It is needless to say that this work has been well and carefully done.

In the chemist's report, among many other interesting topics may be particularly mentioned a study of the fat globules of milk, the lysimeter observations, the records of sunshine, and the digestion experiments, in which artificial digestion is resorted to in order to determine the value of feeding-stuffs.

The whole report is one of which the board of control may well feel proud, and we trust that the director and his corps of able assistants may be enabled to continue with increased facilities the lines of investigation so excellently begun.—*Charles E. Bessey.*

SCHMIDT'S MAMMALIA IN THEIR RELATION TO PRIMEVAL TIMES.[1]—Although Dr. Schmidt, who has died since the publication of this book, was not a special student of the mammals, he was the author of a useful work on comparative anatomy, and well fitted by his general studies for preparing the present interesting sketch. The book is mainly of interest to the American student for its discussion of the fossil mammals of the old world. It is very much behind the times as regards our knowledge of American extinct mammals, as much light has within two or three years past been thrown on the subject by the publications of Cope and of Marsh, particularly the recent generalizations of the former author, which appeared in this journal during 1884 and '85. The extract from Schmidt's book, which appeared in our department of geology and palæontology, shows his mode of treatment of the subject. Equally interesting is his account of the evolution of the pigs, the deer, and especially the oxen. The discussion as to the ancestry of the whales is an interesting one, Schmidt favoring Flower's view that they are an offshoot from the ungulate mammals.

As to the origin of the monkeys and apes, Schmidt suggests that the American group may have descended from the Insectivora, and the old world forms, with the apes, from the Pachydermata, certainly a novel view. As to the origin of man from such a source, he thinks we are justified in postponing any such discussion, "as the study of anthropology can in no way boast of having made any definite progress during the last ten years."

GEIKIE'S CLASS-BOOK OF GEOLOGY.[2]—This is an excellent piece of work, both literary and scientific. In very readable form, with most excellent illustrations, paper and press-work; it is a pleasure to turn over the pages. Everything has been done to make the book and subject attractive to the beginner. We have looked with most care over the early part of the volume, for in physical geology the author is at his best. His treatment of rocks and minerals is excellent, better than anything we know of published in this country; it is so clear simple and attractive. The woodcuts being also unusually well drawn and engraved.

We are a little disappointed with the fourth part on historical

[1] D. Appleton & Co., New York. $1.50.

[2] *Class-book of Geology.* By ARCHIBALD GEIKIE, LL.D., F.R.S. London, Macmillan & Co., 1886. 12mo, pp. 516.

geology. It is scarcely adapted for use in this country, though valuable for reference. The illustrations are mainly of European fossils, and the treatment is rather meager and dry compared with the other portions of the book; the classification adopted is in some points not fresh, and the entire treatment is not what is now wanted.

The *Eophyton linnæanum* is figured as though it were a plant; the *Ceratiocaris* is still referred to the phyllopod Crustacea; the Tunicata are still retained with the brachiopods in that mysterious collection called "Molluscoidea." These, however, are slight defects. But palæontology cannot be set forth in its truest light by one who has not done practical work in biology and palæontology.

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GENERAL NOTES.

GEOLOGY AND PALÆONTOLOGY.

THE PLAGIAULACIDÆ OF THE PUERCO EPOCH.—Three species of this marsupial family have been thus far detected in the beds of the Puerco. These are *Ptilodus mediævus* Cope, Vol. III, Report U. S. Geol. Surv. Terrs., p. 173, Pl. XXIII*d*, Fig. 1; *P. trovessartianus* Cope, l. c., p. 737, AMERICAN NATURALIST, 1885, 493; *Neoplagiaulax americanus* Cope, AMER. NATURALIST, 1885, p. 493. Of these the last-named species is the largest, the lower jaws representing an animal of the probable size of the Norway rat. I am now able to add a fourth species to this list in a second species of Neoplagiaulax, much larger than the *N. americanus*, and hence the largest species of the family known. It is established on an entire inferior fourth premolar. The length of the base of this tooth is one third greater than that of the corresponding tooth of the *N. americanus*, and there are fifteen keel-crests on the side of the crown, while there are but seven in the *N. americanus*. The outline of the crown is of the elongate and moderately convex character of that of the *N. americanus*, and thus not so elevated as in our species of Ptilodus. The irregularity in the outline of the base of the crown is less than in the other species, and the diameter of the roots is subequal. The anterior base of the crown is not excavated for the fourth premolar as in the species of Ptilodus. Length of base of crown 16^{mm}; elevation at middle, 8^{mm}. The discovery of species of this family of increased size was to have been anticipated, in view of the dimensions of the *Thylacoleo carnifex*, which was no doubt descended from the Plagiaulacidæ. I call the animal *Neoplagiaulax molestus*.—*E. D. Cope.*

"LIST OF THE GEOLOGICAL FORMATIONS OF SPITZBERGEN."—The article with the above title, printed in the last December number of the AMERICAN NATURALIST from a manuscript which *eight* years ago I handed to one of the editors of this journal, had well needed a revision before its late publication. As however no opportunity was given me to revise it, I beg to add the following emendations, based on the late discoveries by Dr. Alfred Nathorst, in the expedition under his charge in 1882.

The *Cretaceous system* should be stricken out from the list, the beds previously supposed to belong to this system being *Jurassic* of a higher horizon than the "No. 1, upper beds" at Cape Boheman. The fossil plant determined as *Sequoia reichenbachii* belongs to another genus of conifers, allied to Araucaria.

The *Permian system* should be added to the list, beds of this system existing everywhere on the Ice fiord and Belsound between the Carboniferous and Triassic beds.

In the *Carboniferous system* the "1, upper beds" should be omitted from the list; they are identical with "3, ursastuffe," but placed on the top of "2, calcareous beds" by an inversion which had been overlooked by previous explorers.

The existence of the *Devonian system* on Spitzbergen is no longer doubtful. Nathorst has found, on Dickson bay, and E. Ray Lankester described, characteristic fossils, *e. gr.*, Scaphaspis and Cephalaspida.—*Josua Lindahl.*

NICHOLSON ON STROMATOPORIDÆ.— H. A. Nicholson, in his monograph of the British Stromatoporoids, frankly accepts the views of Carter, Lindström, Zittel and others as to their cœlenterate affinities, and regards them as a special group of the Hydrozoa, having on the one hand relationships with Hydractinia, on the other with Millepora. The skeleton of the typical Stromatoporæ is penetrated by numerous minute flexures, but essentially parallel vertical tubes, not bounded by distinct walls, but enclosed by the vermiculate fibers of the cœnosteum, precisely like the zoöidal tubes in Millepora. These tubes are traversed at intervals by calcareous plates. A detailed comparison between *Hydractonia echinata* Flem., and forms of Actinostroma Nich., shows a remarkable similarity between the chitinous skeleton of the first and the large calcareous cœnosteum of the second. Our author arranges the group in four families, two of which, Actinostromidæ and Labechiidæ, are Hydractinoid, while the Stromatoporidæ and Idiostromidæ may be regarded as Milleporoid. The last family contains genera which have a central, axial, tabulated tube without proper wall, giving off lateral branches, which also divide.

FOSSIL HIPPOPOTAMI.—Dr. Henry Woodward, in a review of the species of Hippopotamus, shows that at least two species (*H. major* = *amphibius*, and *H. minutus*, and probably identical with *H. liberiensis*) occurred in Europe in late Tertiary and early Quaternary time, while four species are known from India. *H. pentlandi*, the bones of which are exceedingly abundant in Sicily, is by Mr. Woodward (agreeing with Professor Boyd Dawkins) considered to be identical with *H. minutus* from the caves and fissures of Malta.

The Indian species are *sivalensis*, *iravaticus* and *namadicus* from the Siwalik hills, and *palæindicus* from the Narbadas.

MINERALOGY AND PETROGRAPHY.[1]

MINERALOGICAL NEWS.—The late Dr. Lasaulx, of Bonn, recently examined[2] very thoroughly the mineral corundum with reference to its microstructure and optical properties. The fact that sections of this mineral cut perpendicular to the vertical axis often show a biaxial interference figure in converged polarized light has been known for some time. Lasaulx attempts to find the cause of this. Sections of crystals from nine localities were carefully made and thoroughly studied. In summing up the results of his examinations he concludes that (1) corundum is undoubtedly a uniaxial mineral, crystallizing in the hexagonal system; (2) the anomalies in optical properties are due to irregularity in growth; (3) this irregularity in growth often gives rise to a zonal arrangement in which the different zones are in twinning position to each other, the twinning planes and planes of growth being identical; (4) the optical anomalies are due in some cases to tension in the individual zones. Compression obtained in a direction normal to their greatest extension in the base; consequently the plane of the optical axes is parallel to this direction of the lamellæ; (5) in other cases where the different lamellæ are twinned, optical disturbances are produced; finally (6) decomposition may give rise to aggregate polarization. ——Orthoclase has been found for the first time as a druse mineral in leucite-tephrite.[3] In the cavities of this rock were found crystals of phillipsite, calcite, orthoclase (adularia), altered pyrite and calcite again, in a regular order of deposition. The adularia occurred in groups covering the phillipsite and also in perimorphs of calcite. Crystals of the latter mineral were covered with a druse of adularia, and showed under the microscope a rim with aggregate polarization, as if the calcite substance were gradually being replaced by adularia.——In an article on göthite,[4] Ed. Palla declares as a result of a series of measurements on crystals from Cornwall, that the mineral is either orthorhombic with the axes $a:b:c = .9163:1:.6008$, or monoclinic with $\beta = 90° 36' 25''$ and $a:b:c = .9164:1:.6008$. If the former view is taken the planes $\infty\breve{P}\frac{02}{100}$, $\infty\bar{P}\frac{100}{52}$, $\infty\bar{P}\frac{102}{50}$, $\frac{102}{100}\breve{P}\frac{102}{100}$, $\bar{P}\frac{102}{100}$ and $\bar{P}\frac{100}{52}$ must be considered as vicinal; whereas if the mineral is considered as monoclinic these (with the exception of the first) become $\infty\not{P}\frac{100}{52}$, $\infty\not{P}\frac{100}{52}$

[1] Edited by W. S. BAYLEY, Johns Hopkins University, Baltimore, Md.
[2] Zeitschrift für Krystallographie, x, p. 346.
[3] V. von Zepharovich. Zeitschrift für Krystallographie, x, p. 601.
[4] Zeitschrift für Krystallographie, xi, p. 23.

$-P, +P, -\bar{P}_2$. Thin plates parallel to the cleavage are translucent to transparent with very weak pleochroism if any. The positive bisectrix is probably perpendicular to the cleavage plane. The dispersion very large, $\upsilon > \rho$, so that for red light the mineral is uniaxial. For green and blue light, however, the optical angle is about 50°. In all its optical properties it resembles rutile very closely.——In attempting to prove by means of etched figures[1] that cryolite is without doubt a monoclinic mineral, Baumhauer[2] has succeeded in showing that in the massive mineral two crystals are so united that (1) ∞P and oP of the one are parallel respectively to ∞P and oP of the other; or (2) ∞P of the first is parallel to oP of the second, and *vice versa.*——Crystals of struvite with a different habit from any heretofore described have been found at Homburg v. d. H., and investigated by Kalkowsky.[3] The planes observed were $P\breve{\infty}$, oP, $2P\breve{2}$, $2\hat{P}\hat{\infty}$, $\infty P\breve{\infty}$, $P\bar{\infty}$ and $\infty P2$. In physical properties the mineral from this locality also differs from that found elsewhere, $a:b:c = .5685 : 1 : .9113$. The acute bisectrix is the macrodiagonal. The crystals are hemimorphic with oP the analogue pole.——Friedel,[4] of München has analyzed pure staurolite from Framnitzberg, and found it to correspond to the formula $H_4 (Mg\,Fe)_6 (Al\,Fe)_{24} Si_{11} O_{66} = (Mg\,Fe)_6 Al_6 (Al\,O)_{18} (O\,H)_4 (SiO_4)_{11}$, in which the oxygen ratio is 2 : 1.——Doelter[5] has recently succeeded in effecting the synthesis of several minerals of the group of the sulphides and sulpho-salts by the use merely of those reagents which exist naturally, and at a temperature much lower than that usually employed in such experiments. Pyrite was obtained in crystals by the action of sulphuretted hydrogen on hematite at a temperature of 200°, and also by the action of an aqueous solution of the same reagent on siderite and magnetite, in sealed tubes at 80°–90°. Galena was obtained by heating together cerussite and an aqueous solution of hydrogen sulphide in a sealed tube to the same temperature. Crystals of cinnabar, covellite, chalcocite, bornite, chalcopyrite, bournonite, miargyrite and jamesonite were all obtained by methods analogous to one or the other of these, and in no case was a high temperature required. The results are of considerable interest as affording a ready means of explaining the origin of some of the most common minerals we have to do with.——Messrs. Friedel and Sarasin[6] recently heated together a mixture of precipitated calcium carbonate and a solution of ten grams of calcium chloride in 60–70^{cc} of water in a stell tube lined with platinum. After ten hours heating at 500° the mixture was

[1] Cf. AMERICAN NATURALIST, 1886, February, p. 158.

[2] Zeitschrift für Krystallographie, XI. p. 133.

[3] Ib., XI, p. 1.

[4] Ib., X, p. 366.

[5] Ib. XI, p. 29.

[6] Bulletin de la Société Minéralogique, July, 1885, p. 304.

found to contain little rhombohedra of calcite. With twenty grams of calcium chloride rhombohedra were obtained, which gave on measurement an angle of 105° 46′. Several experiments were made, but in no case was any aragonite formed. ——Hæmostilbite is described by Igelström[1] as a new mineral from the iron mine of Sjoegrufvau, Grythyttan parish, Sweden. It is of a blood-red color by transmitted light, and is found in a gangue of tephroite in fissures with calcite, in a bed of limestone in granulite. An optical examination by Bertrand proved the mineral to be orthorhombic. The acute bisectrix is negative and is perpendicular to the easy cleavage. The optical angle is small and the dichroism very pronounced. In hardness and general appearance it approaches haussmannite. An analysis yielded:

Sb_2O_5	MnO	FeO	Mg(Ca)O
37.2	51.7	9.5	1.6

This composition is represented by the formula, 8MnO, Sb_2O_5, or 9MnO, Sb_2O_5, which is very near that of another mineral already described under the name of manganostilbite, with which the hæmostilbite may be identical.

Petrographical News.—A very interesting article has just appeared in the Beilage Band of the Neues Jahrbuch,[2] on the geological and petrographical relations of the porphyries of the Central Alps. In it the author, C. Schmidt, describes the massive rocks of the Grosse and Kleine Windgälle. Among the Jurassic schists an iron-oölite was found. This consists of a reddish limestone containing oölites composed of magnetite, both massive and crystallized, in a groundmass of calcite and hematite, with a rim of a green fibrous mineral which the author thinks might be the chamosite of Bertier. The crystalline rocks are principally gneisses, hornblende rocks (including a peridotite and a porphyritic rock composed of large aggregates of hornblende in a coarse-grained plagioclase in which is also a large amount of augite in smaller granular aggregates) and quartz porphyries, which are divided into five types. As a result of the pressure to which these porphyries have been subjected, some of them are found to pass over into a completely schistose rock in which the original constituents can be traced under the microscope by means of their alteration products. From a study of the granitites and porphyries from other localities in the same region, Schmidt concludes that the Windgälle rock is either a facies of granite or a distinct rock mass, and that it is not possible to declare positively which of these is really the case. The paper is well illustrated by a map and five sections.——Michel Lévy has

[1] Bulletin de la Société Minéralogique, June, 1885, p. 143.

[2] Neues Jahrb. für Mineralogie, etc., Beil. Bd., IV, 1886, p. 388.

recently examined[1] a rock from the left bank of the Jamma, a tributary of the Blue Nile. This rock consists of the remains of orthoclase of the first generation in a groundmass of secondary quartz with little crystals of nepheline, orthoclase and amphibole. It is, according to Lévy, a type of rock between the tephrites and the phonolites.——In the same journal Lacroix has a note[2] on the basaltic rocks of County Antrim, Ireland. These are labrador basalts with a typical ophitic structure. They contain the following minerals in the order of their crystallization: apatite, magnetite, olivine, labradorite and pyroxene in lathe-shaped crystals, palagonite, hematite, chlorite and zeolites. The zeolites are in the cavities of the rock. A search was made for the native iron mentioned by Andrews as occurring in these rocks, but none was found.——Four additional parts of the "Erläuterungen zur geologischen Specialkarte des Königreichs Sachsen"[3] have just been published. The sections described are Oschatz-Mügeln by Th. Siegert, Falkenstein by Schröder, Wurzen by Schalch and Auerbach-Lengenfeld by Dalmer. These authors describe the Eibenstock tourmaline granite, the Kirchberg granitite and the slates and sandstones metamorphosed by them.

Miscellaneous.—The Denison University of Granville, Ohio, has just issued, in its Bulletin of the Laboratories of Denison University, a compendium of petrographical manipulation by C. L. Herrick. The first part is a condensation of the theoretical part of Hussak's book, in which many of the errors of the original have been rectified. The methods in use for the preparation and examination of rock section are described as clearly as might be expected in a treatise of such small size. Unfortunately a few mistakes still remain to confuse the student who attempts to make use of this little work without the aid of an instructor to explain away his difficulties. Most of these errors, however, seem to be due to too much hurry on the part of the composer. On page 132, for instance, the axes of elasticity are spoken of as optical axes. The second part is a translation of Hussak's tables. It is safe to say that in the hands of a consciencious teacher this little pamphlet of Mr. Herrick's will prove of great value to students who desire merely to gain some insight into the methods so generally made use of at present in the study of rocks.

BOTANY.[4]

Carbonaceous Reserve Food-materials in Fungi.—M. L. Errera points out in the Comptes Rendus of the French Academy of Sciences a close analogy in this respect between fungi and flowering plants. In the seeds, tubers, &c., of Phanerogams

[1] Comptes Rendus, CII, No. 8, p. 451.
[2] Ib., 454.
[3] Cf. American Naturalist, April, 1886, p. 374.
[4] Edited by Professor Charles E. Bessey, Lincoln, Nebraska.

the food-material may be stored up either in the form of starch, inulin, &c., on the one hand, or in that of oil on the other hand. Exactly the same difference is observable in fungi, substituting only glycogen for starch or inulin. The great reservoirs of food-material in fungi are the sclerotia. The sclerotia of *Claviceps purpurea* contain oil, those of *Coprinus niveus*, *Peziza sclerotiorum*, &c., glycogen, while in other cases the food-material is accumulated, as in some seeds, in the form of thickenings of the cellulose-walls.

When sclerotia which contain glycogen germinate, the glycogen gradually decreases, while it accumulates in the growing fungus, in the stipes, pileus and lamellæ, into which it appears to pass directly from the sclerotium. In the germination of the sclerotia of ergot the oil rapidly disappears and is replaced by glycogen, which is, however, only of a temporary persistence, soon disappearing, and again making its appearance in the part when the fructification is subsequently formed. This resembles closely the phenomena which attend the germination of oily seeds like those of Ricinus and Cucurbita. Transitory glycogen is also formed in the germination of the spores of many fungi.—*A. W. Bennett.*

HENSLOW'S STUDIES OF EVAPORATION OF WATER FROM PLANTS. —In December, 1885, the Rev. George Henslow read a paper before the Linnean Society entitled, "A contribution to the study of the relative effects of different parts of the solar spectrum on the transpiration of plants," which is of such interest that we reproduce its more essential parts. After reviewing the work of other observers the author describes his method of work, which consisted in using glasses of different colors:

"The plan I finally adopted was to grow small plants in miniature pots two inches high and nearly two inches in diameter. These can be entirely wrapped up in gutta-percha sheeting, which is carefully bound round the stem of the plant with cotton-wool within and around the stem. This effectually prevents any evaporation from the surface of the earth or pot; and all loss of weight is due to the transpiration from the exposed surface of the plant alone.

"My experiments were made upon lettuce, box, Echeveria, small seedling palms, ferns, cactus and many other kinds of shrubs and herbs; having selected them with very various degrees of density in the epidermis, as well as of different families. The results would seem to entirely corroborate the conclusion of Weisner, that transpiration is mainly effected by the red, blue and violet rays, while the (optically) brightest rays of yellow and green are generally less able to effect it, *even if they do not hinder it.* I emphasize this sentence, as there appear to me to be grounds for coming to such a conclusion, as will be seen hereafter."

After detailing his experiments the following is given as the conclusion: "The above experiments, selected from a large series, seem to me to abundantly prove that Weisner's results are correct; and while recognizing the fact that obscure heat-rays cause a certain amount of the loss of water by evaporation, that transpiration *per se* (theoretically distinct from the purely physical process of evaporation, which takes place from all moist surfaces and bodies, dead or alive) is especially, if not solely referable to those particular bands of light which are absorbed by chlorophyll, and that such light, being arrested, is converted into heat, which then raises the temperature within the tissues and causes the loss of water. The only additional fact which I have here advanced, somewhat tentatively, is, that yellow light has a *retarding influence* upon transpiration, for the reasons given above. That 'life' has a retarding influence upon evaporation as distinct from transpiration, I think my experiments (which I hope to continue hereafter) have distinctly proved."

It will puzzle any one to make out a good reason for using two terms for the process of water-loss in plants. We have it said that "evaporation" is the "purely physical process," while the experiments show that what is called "transpiration" is, after all, a physical process also; and when we are told, as in the last sentence above, that "life has a retarding effect on evaporation," the confusion of ideas becomes somewhat embarrassing. Why not use but one term, and that the more general one—evaporation? The fact of modification or control of evaporation is so common a phenomenon in nature that we cannot regard it as of great significance. Common salt or sugar added to water retards evaporation.

The mutual attraction of the molecules of cellulose and water retards evaporation; so does the mutual attraction of the molecules of protoplasm and water. Heat increases the rate of evaporation, while a reduction of temperature (other things being equal) retards it, etc., etc. Why not call the loss of water in the plant what it is—evaporation, and then discuss the several modifying influences? Certainly such a course would contribute to clearness and accuracy, and would relieve the beginner of one of the difficulties in vegetable physiology.—*Charles E. Bessey.*

ELLIS AND EVERHART'S NORTH AMERICAN FUNGI.—The sixteenth and seventeenth centuries of this valuable distribution of dried specimens of the fungi were sent out early in March. With the fifteenth century the first series of centuries closed, and in order to mark its termination Mr. Everhart prepared an alphabetical index to all the species. The first fifteen centuries were published by Mr. Ellis, but now with the beginning of the new series the name of Mr. Everhart appears upon the title-page and the labels. As Series I included fifteen centuries, we may confidently hope that Series II will carry the work up to thirty centuries!

The centuries before us are largely devoted to the Sphæriaceæ and the so-called "imperfect fungi." The genus Cercospora is represented in Cent. XVI by twenty-five species, many of which have been but recently described. Septoria is represented in Cent. XVII by sixteen species, Sphærella by eleven.

We trust that this important work, which must be largely a labor of love, will go on to the completion of the second series, so happily begun.

Botanical News.—From the Transactions of the Institute of Natural Science of Nova Scotia we have a paper on the Canadian species of the genus Melilotus, by Professor George Lawson.——The eleventh annual report of the American Postal Microscopical Club contains a couple of pages of suggestive botanical notes from the "note-books" of the club.——Superposed buds are discussed by Aug. F. Foerste in a late number of the Bulletin of laboratories of Denison University. The paper is accompanied by a plate.——Dr. Farlow's paper on Biological teaching in colleges, published in the March number of the *Popular Science Monthly*, will be read with interest by every teacher of the "laboratory method" in botany.——The March *Journal of Mycology* contains descriptions of the species of Phyllosticta, Claviceps and Cordyceps, and also a sketch of the life and labors of the botanist Schweinitz, the latter accompanied with a portrait.——The March number of *Grevillea* is accompanied by pp. 113 to 128 of the new edition of Cook's Hand-book of British Fungi. Thus far the descriptions include 456 species, all of the genus Agaricus.——Late numbers of *Flora* contain an important paper, Zur Systematik der Torfmoose, by Dr. Röll of Darmstadt. The "collective species," with their numerous varieties and forms, are fairly bewildering, and strongly suggest the inadequacy of the Linnæan nomenclature.——The Bulletin of the Torrey Botanical Club has been much improved the present year. Its Index to recent American botanical literature is now one of its most valuable features. In the February number L. H. Pammel publishes a paper on the structure of the testa of several leguminous seeds, accompanied by two plates.——In the March *Botanical Gazette* D. H. Campbell describes the development of the root in *Botrychium ternatum*, and J. N. Rose contributes an article on the mildews (Erysiphei) of Indiana. The June number of this invaluable journal is to be devoted to field and herbarium work, and hence will be of particular interest to collectors.——Henry Holt & Co., of New York, announce for early publication a Hand-book of plant dissection, by J. C. Arthur, C. R. Barnes and J. M. Coulter.

ENTOMOLOGY.

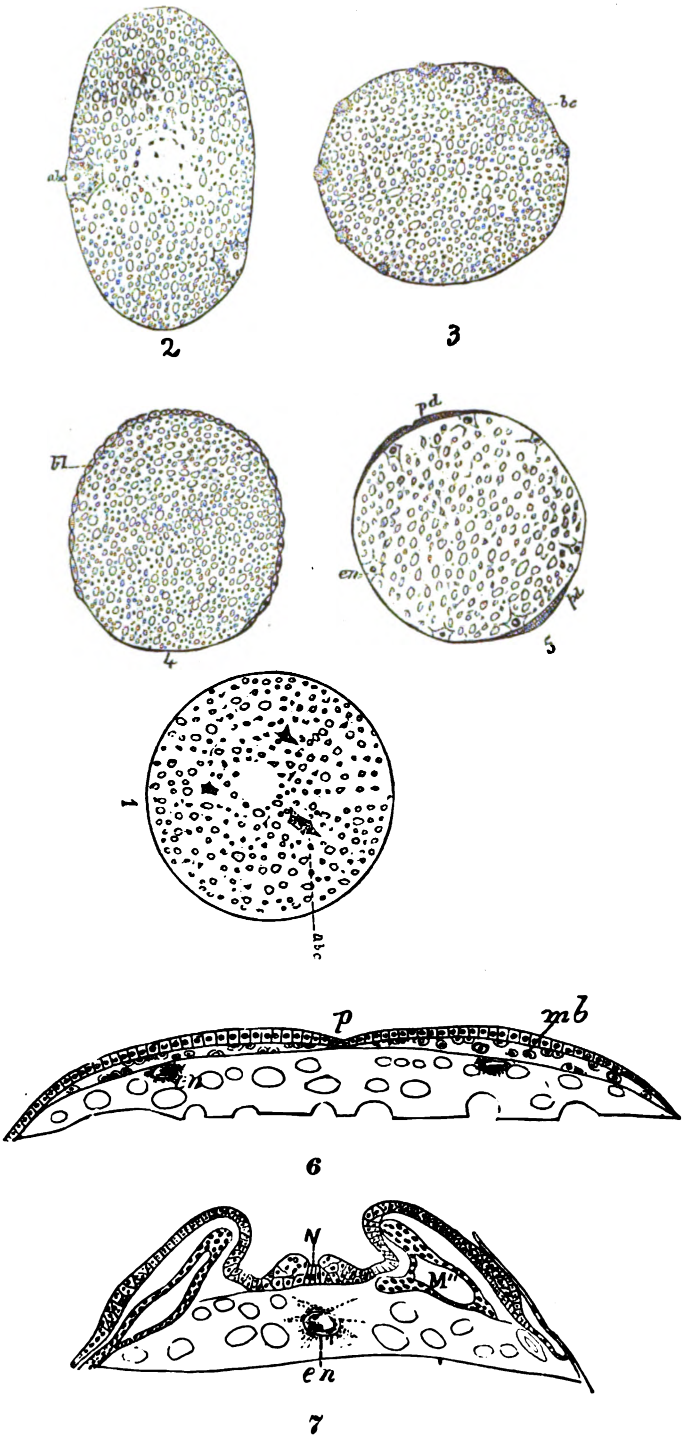
Development of the Molé Cricket.—A. Korotneff has published in the Zeitschrift für wissen. Zoologie, XLI, 4, 570, a well illustrated essay on the embryology of the mole cricket, which has been also noticed by C. Emery in the Biologisches Centralblatt for Jan. 15, in connection with Grassi's observations on the development of the honey bee. The egg of the mole cricket has an abundant yolk, while that of the bee has little yolk and is small and transparent. Yet both observers have independently arrived at the same results in four important points. It is noteworthy that in both forms before the formation of the blastoderm a stage was observed in which the amœboid embryonal cells seemed to possess no clear nuclei. With this result might be connected the relation briefly described by A. Sommer in the case of a Podurid, when the ripe egg was entirely without a nucleus. Whether there was in all these cases a genuine absence of the nucleus, or a diffuse nucleus form, such as Graber discovered in the Protozoa, is still to be determined, and would not be without interest in connection with the late reflections of Weismann and others on heredity.

In Gryllotalpa the embryonic cells are at first scattered over the surface of the egg; some migrating into the deeper parts of the yolk and forming the yolk cells regarded by Korotneff as the primary mesoderm. From the ectoderm exclusively separates the endoderm. There first originate, under the ectoderm cells which Korotneff denotes as mesenchym, and not till later does the separation of the myoblasts follow along the ventral median line. Later still arise from the ectoderm near the tracheæ other groups of cells which are also to be considered as mesenchym, and which were also observed in Bombyx by Tichomiroff.

The embryonal membranes serosa and amnion arise as ectodermal folds. After the limbs are indicated the segments are formed. Korotneff enumerates eighteen segments, *i. e.*, four in the head, three in the thorax, ten abdominal and one tail-segment (Tichomiroff observed the same number in Bombyx. The nervous system primarily shows a corresponding organization in seventeen pairs of ganglia, which are reduced to thirteen by the consolidation of the three hinder head-ganglia (in the text they are erroneously called thoracic ganglia) and the three last abdominal ganglia. The cerebral ganglia are first separated from each other and only joined to the ventral chain by slender commissures. The structure called "chorda" by Nusbaum is a median ectodermal one, which grows in between the two series of ganglia, and has nothing at all to do with the formation of the connective tissue of the nervous system. This last tissue must arise from the immigrating blood-cells.

Especially interesting are the observations on the structure of

PLATE XVIII.



the entoderm and digestive canal. The cells of the primary entoderm (the yolk cells) undergo a radial division of the yolk, the yolk-pyramids thus arising melting into each other centrally. Some of the cells grow and form, under the serous membrane which has not yet disappeared, the dorsal wall of the body, and the dorsal plate or dorsal organ. Through the growth of the parts forming the lateral walls of the body, the dorsal organ gradually becomes covered, its cells sink into the yolk and seem to break into fragments. After the ectodermal parts of the digestive canal (fore and hind intestine) have formed, amœboid cells still migrate into the yolk, and seem to contribute to its fluidity (verflussigung). After hatching, the whole yolk by a pumping movement, gradually becomes, including whatever is contained in the same, partly degenerate cells, thus pushing the so-called primary entoderm into the portion of the fore-intestine, called the crop. The mesenteron receives no epithelial covering from the primary entoderm, and the epithelium of the mid-intestine, namely, the definite or secondary entoderm, arises from the mesoderm, according to Korotneff, through the wandering blood-cells. The morphological significance of the strange dorsal organ is, according to Korotneff, nothing else than a stopper which fills up the dorsal gap of the body-walls of the embryo. Physiologically the organ plays an important rôle in the manufacture of the yolk-mass destined for the nourishment of the embryo. In the digestion of the yolk, so to speak, three kinds of cells are active: 1, the yolk cells; 2, the dorsal organ; 3, immigrant blood corpuscles. By the above considerations the want of a dorsal organ in eggs with a scanty yolk is explained.

The formation of the heart is very fully described. We will only give the following abstract. Blood cells are early present almost everywhere between the yolk and mesoderm; the heart becomes indicated in the form of two furrows, which draw near to one another together with the dorsal edges of the myoblasts, and which unite in the heart-tube; each furrow borders a wide blood-lacuna which covers the dorsal side of the yolk and becomes reduced to the cavity of the heart.

EXPLANATION OF PLATES XVIII AND XIX.

Lettering.

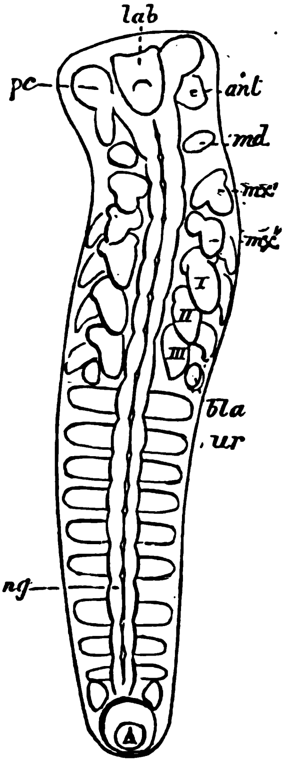
abc, amœboid blastodermic cells.
ant, antenna.
ar, arterial sinus.
bc, blastoderm cells.
bl, blastoderm.
bla, abdominal vesicles.
cr, proventriculus, or crop.
dm, ventral diaphragm.
do, dorsal organ.
dpm, dorsal diaphragm.
en, endodermal cells.
ent, enteric layer.
f, fat-body.
g, ventral ganglion.
H, *ht*, heart.
l, lacuna.
M', cavity of the myoblast.
m, mouth.

mb, myoblast cells.
md, mandible.
men, mesenteron.
mx', 1st maxilla.
mx'', labium, or second maxilla.
ml, leaf-like portion of mesenteron.
N, nerve-furrow.
œ, œsophagus.
P, primitive groove.
pc, procerebrum.
pd, primitive disk.
pm, proctodæum.
sg, subœsophageal ganglion.
sm, stomodæum.
tg, thoracic ganglion.
vm, ventral muscle.
y, yolk.
yp, yolk-pyramids.
I, 1st pair of feet.
II, 2d " "
III, 3d " "

FIGURES.

FIG. 1.—Egg in which the amœboid (*abc*) nuclei are moving toward the surface.
" 2.— " " " " " have reached the surface, and show an active nucleus-formation.
" 3.—The blastodermic cells have no nucleus, and are placed at equal distance apart.
" 4.—The blastoderm cells now forming a continuous layer.
" 5.—Cross-section of the egg with blastodermic disk, also showing the disposition of the endodermal cells.
" 6.—Cross-section of the blastodermic disk, with the myoblast cells (*mb*) already formed.
" 7.—Cross-section through the thorax of the embryo; the body-cavity extended into the limbs.
" 8.—Longitudinal section of the embryo; the yolk-pyramids (*yp*) form a common inner yolk-mass (*y*).
" 9.—Section through the heart; *H*, cavity of the heart; the two halves of the heart-sinuses having united dorsally, ventrally they are still open and are bounded by the walls of the mesenteron.
" 10.—Cross-section of an embryo, showing the blood-lacunæ separated on the back by the dorsal organ (*do*); the intestinal fasciated layer (darmfaserblatt) has not completely enclosed the yolk.
" 11.—Embryo completely segmented, with the rudiments of the appendages, labrum (*lab*) and nervous ganglia (*pc–ng*).
" 12.—A more advanced embryo, showing the stomodæum (*st*) indicated as a frontal protuberance.
" 13.—Section through the recently hatched larva, showing the cells of the mesenteron or chyle-stomach, and the cellular layer on the front surface; also the proventriculus or crop.

DEVELOPMENT OF THE HONEY BEE.—An abstract of Grassi's observations appears in the Biol. Centralblatt, which we translate. The development of the honey bee is much more simple in some respects than that of the mole cricket because the necessary structures for the digestion of the food yolk are entirely lacking. Yolk cells exist after the formation of the one-layered blastoderm, but do not limit the cleavage of the yolk. The blastoderm is at first spread continuously over the whole egg, but afterwards becomes arrested upon the back. The mesoderm so arises from the ectoderm that a median ventral plate at the same time sinks in and becomes overgrown by the adjoining later parts. This plate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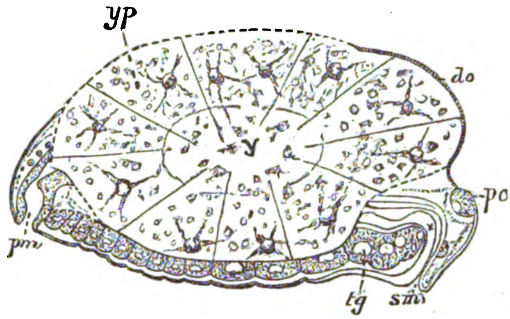
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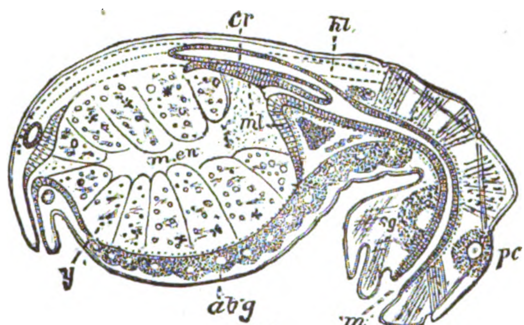
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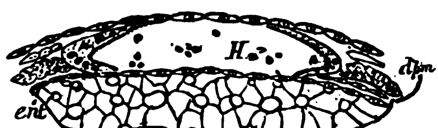
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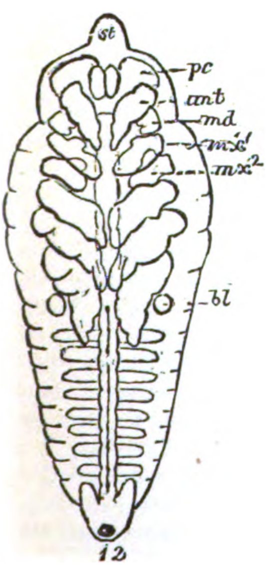
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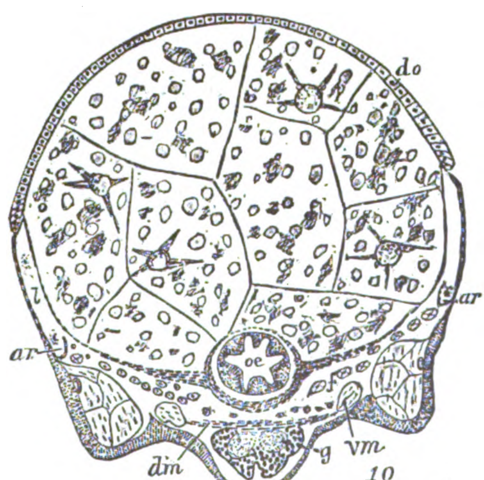
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is at first one-layered, and afterwards is composed of two layers, and then divides for the formation of the body-cavity. The posterior and anterior ends of the mesoderm-plate lengthen to form the mesoderm of the head and end of the abdomen. From these last portions of the mesoderm arises also the definite entoderm, viz., the epithelial covering of the mesenteron. The yolk cells thereupon disappear; according to Grassi the figures quoted from Tichomiroff as well as from O. and P. Hertwig, in regard to the proof of the origin of the endoderm in the yolk cells can also be explained to agree with his views. The amnion and serous membranes are not separated in the bee, but form a single layer of cells. Grassi is inclined to trace the embryonal membranes of insects phylogenetically from an especially modified dermal fold, which was inherited from the ancestors of the class; such a duplicature, suggests Emery, might be comparable to the mantle of many Entomostraca.

According to Grassi the cerebral ganglia arise independently of the ventral chain, and is afterwards connected with it. The entire nervous system and, as far as could be observed, also the commissures arise directly from the ectoderm. The antennæ are developed from the head plate (procephalic lobes) and are situated in front of the other appendages. A pair of cephalic appendages previously observed by Bütschli, which only appear for a short time in front of the mandibles, soon disappear. Grassi considers them as homologous to the second antennæ of Crustacea. He found abdominal appendages only exceptionally, and not on all the segments. The observations of Grassi on the mode of development of the heart agree well with those of Korotneff on Gryllotalpa; both uphold the hypothesis of Bütschli of the origin of the vascular system from the residue of the segmentation-cavity, *i. e.*, the primitive body-cavity. The sexual organs originate as two mesodermal elongated streaks in the 4th–8th abdominal segments.

The tracheæ arise very early; there are ten pairs of stigma present, the 1st thoracic and the two last abdominal segments wanting the same. In the corresponding place of the two last segments appear the germs of the malpighian tubes, which as soon as the hind-intestine is formed extend and open into it. Tracheæ and urinary tubes should be regarded, as P. Mayer supposed, as homodynamic organs. This opinion is also supported by the results of Tichomeroff's researches on the silk-worm; the latter found nine pairs of stigmata, but three pairs of malpighian tubes. Grassi further supposes that the silk glands and other invaginations or "head-canals" found by him near the mandibles and maxillæ are homologous with the tracheæ.

In case an entodermal origin for the antennal glands of the Crustacea and the segmental organs (schleifenkanali) of annelids becomes proved, then the first might be the homologues of the head-canals of the bee-embryo, and both the tracheæ and malpighian tubes be proved homologous with the nephridia of the annelids.

From such a view Emery dissents: he thinks the relation of these organs in Peripatus are not consistent, since in that animal occur both nephridia and trachea, unless we suppose that the tracheæ of Peripatus and of the other arthropods are not equivalent. If one accepts the fact that the tracheæ and the malpighian tubes have originated from diffusely distributed cutaneous glands, then one could further suppose that their openings unite later with the openings of the nephridia, by which means they assumed a segmental arrangement. But, however, it is not at all necessary to make the nephridia arise from the ectoderm, which would contradict all the researches hitherto made.

LINTNER'S SECOND REPORT AS STATE ENTOMOLOGIST OF NEW YORK.—This forms a volume of 265 pages, representing work done in the years 1882 and 1883. Besides many miscellaneous notes on various local attacks of insects and remedies, certain well-known injurious caterpillars are described at length, as well as noxious flies, beetles, bugs and orthopterous and neuropterous insects.

In the appendix, reprinted from other sources, is described a new sexual character in the pupa of some moths, and an egg parasite of the currant saw-fly is described, while besides is a list of notes of a miscellaneous nature published in various journals, succeeded by a reprint of Fitch's Winter Insects of New York.

The report is rather more miscellaneous and contains perhaps the results of less field work than the first, but still will prove serviceable to the farmers of New York.

The State should be more liberal in affording illustrations for so important and useful a report, those not reproduced being poorly drawn and engraved. This is not the fault of the entomologist, and should not be under the control of the State printers.

ENTOMOLOGICAL NEWS.—At the meeting of the French Academy for Jan. 25, M. J. Chatin read a note on the comparative morphology of the labium in Hymenoptera.——In the Bulletin of the Buffalo Society of Natural Sciences (Vol. v, 1), Dr. D. S. Kellicott describes as new *Nonagria subcarnea*, and compares its larva with that of *Sphida obliquata*.——In the *Canadian Entomologist* for January Mr. Herbert Osborn publishes a useful preliminary list of the species of mites of North America.——In *Entomologica Americana* for March, D. W. Coquillet gives a synopsis, with descriptions of new species, of our species of bombylid flies of the genus Toxophora. Miss M. Murtfeldt shows that certain seed-feeding Coleophora larva, which remain ten or eleven months, and sometimes even longer, in a dormant state, not feeding in the spring or summer months.——Mr. H. B. Möschler discusses the systematic position of the genus of zygænid moths, Triprocris.——At the meeting of the Washington Entomological Society for Feb. 11, Mr. Schwarz said that among the many forms of secondary sexual characters in the Coleoptera, some would likely be found to be analogous in function to those in the Lepidoptera. He referred more particularly to the tufts of hair in the mentum of Trogosita, and those on the ventral segments of the male of Dermestes. Differences in the vestiture of the sexes are known to occur, *e. g.*, Hoplia, where the male has scales and the females only hairs; but in this case it is hardly possible that we have to do with odoriferous organs.

ZOOLOGY.

Markings of Animals.—Eimer has advanced the view that the markings on animals are primitively longitudinal stripes, which may subsequently be broken up to form dots, and these fuse to form transverse rings. This view is supported by the ontogeny of many animals. Dr. W. Haacke controverts this view from the study of an Australian fish, *Helotes scotus.* The adult fish is marked by eight longitudinal black bands; young specimens have in addition a row of clear transverse bands, which disappear when the fish attains to maturity.—*Journ. Roy. Micr. Soc., February, 1886.*

Blind Crabs.—Mr. J. Wood-Mason states that four species of Brachyura were dredged in the Bay of Bengal from depths exceeding 100 fathoms, during the past season, by H. M.'s Indian marine survey steamer *Investigator.* They belong to the genera Amathia, Ethusa, Eucephaloides (n. gen. allied to Collodes Stimpson) and Lyreidus, of which the last named (*L. channeri*) is especially interesting on account of the rudimentary condition of the eyes.

These organs are unequally reduced, the cornea of the left being of the normal form and extent, but opaque and devoid of all traces of facets, as in Munidopsis, Orophorhynchus, Nephropsis and other blind forms of the deep sea, while that of the right is entirely aborted, its place being only indicated by a small smooth spot marked out by the transparence of a lead-colored pigment similar to that which is seen through the integument around the base of the left eye. This interesting brachyuran, which is at once distinguished from the Japanese and American species by having the anterolateral margin of the carapace armed with two pairs of long and slender spines, were trawled up from a depth of 285–405 fathoms.—*Jour. Roy. Micr. Soc., February, 1886.*

The Intercentrum in Sphenodon (Hatteria).— Professor Cope, in his important note on this point (Am. Nat., Feb., '86) has shown that the intercentrum in Sphenodon is complete in the caudals; I can add that the same condition is to be found in the præcaudal vertebræ also. This makes Professor Cope's view of the Embolomeri being the batrachian type ancestral to the Reptilia, still stronger.

Fritsch[1] believes that he has found the representatives of the pleurocentra in the cervicals of a young Sphenodon; the præzygapophyses, he says, represent these elements; which are developed from a distinct point of ossification (according to Fritsch). I examined two Sphenodons in alcohol (one about 290^{mm} long). I could not find such a condition, and nobody will find it, not even in embryos. Archegosaurus has well developed præzygapophyses, *besides* the pleurocentra. In *no* vertebrate are the præzygapophyses developed from a distinct center; and Sphenodon makes no exception. The "centrum" of the vertebra in reptiles and mammals is formed by the pleurocentra; and embryology of the Reptilia will probably show that the centrum is developed from two lateral elements.—*Dr. G. Baur, March 23, 1886.*

Zoological News.—*Mammalia.*—H. H. Johnson, in his work on the Kilimanjaro expedition, notes a singular resemblance (which some may call mimicry) between the aspect of the tall red-brown antelope, *Alcelaphus cokei*, and the mounds built by termites. The color being the same and the long grass hiding the animal's legs, it was really difficult to distinguish an antelope from an ant hill. The mimicry was sometimes made more ludicrously exact by the sharply pointed leaves of a kind of squill, which suggested the horns of an antelope.——F. W. True has described in a recent issue of the Proc. U. S. Nat. Mus. a new species of Mesoplodon (*M. stejnegeri*) obtained on Bering island by M. Stejneger. The species rests upon the characters of the cranium, quite badly water-worn, of a young individual. In general proportions it agrees with the skull of *M. hectori*, but the contour of the occipital, the section of the beak, etc., are different.——Mr. True pronounces the *Hyperoodon semijunctus* of Cope to be a Ziphius, distinct from *Z. cavirostris.* In the general form and proportion the skull approaches most closely to *Z. gervaisii.* ——Sowerby's whale (*Mesoplodon bidens*) has been found upon the coast of Yorkshire. A male specimen fifteen feet nine inches long was left stranded in shallow water at the entrance to the Humber. Fourteen instances of the occurrence of this species on various parts of the European coast and one in North America (Nantucket, 1867) are enumerated (*Ann. and Mag. Nat. Hist.*, Jan., 1886).

Reptiles, etc.— Mr. A. B. Macallum (Quart. Journ. Mic. Soc., Nov., 1886), gives the following summary of the results of his

[1] Fritsch, A. Fauna der Gaskohle. Bd. II, Heft II, Prag, 1885.

studies of the nerve terminations in the cutaneous epithelium of the tadpole. Certain fibers, placed below the corium and known as the fundamental plexus, give origin to fibrils which enter the epithelium and end in comparatively large bead-like bodies between the cells, and may or may not branch, arise from a network of fine anastomozing nerve-fibrils situated immediately below the epithelium and forming meshes smaller than the space covered by an epithelial cell. One, commonly two, often three or more, nerve-fibrils terminate in the interior of each epithelial cell near its nucleus. The figures of Eberth are sheaths for intra-cellular nerve-terminations.—— Colonel R. H. Beddome describes the earth snakes (Uropeltidæ) of India and Ceylon in a recent number of the *Annals and Mag. of Nat. Hist.* Six species of Rhinophis, one of Uropeltis, nineteen of Silybura, five of Plectrurus, one of Teretrurus (nov. gen.), three of Melanophidium, and three of Platyplectrurus are characterized. Several species are new.

Fishes.—*Nature* (Feb. 4, 1886) has an interesting article by A. Ernst upon the shoals of living and dead fishes which are cast upon the shore of Carupano, Venezuela. The place is celebrated for the occurrence of these shoals, which for the most part consist of small fishes, and are composed of several distinct species. The shoals are most common from May to November, during the rainy season, but in fine weather, when there is a moderate breeze from the sea. Sharks and other predatory fishes, as well as whales and sea-gulls, follow the shoal. The movement of the fishes is probably due to migration in search of food, the conformation of the coast at Carupano is such as to favor the embayment of the shoals at that point, and the death of the fishes is caused by submarine eruptions of gases. —— T. J. Cunningham (Quart. Jour. Micr. Soc.) contributes observations upon the relations of the yolk to the gastrula in teleosteans and other vertebrate types. At an average temperature of 7.5 C. whiting began to hatch on the tenth day, haddock on the eleventh. The fertilized ova of the cod, haddock and whiting are similar in all respects save size, while the ovum of *Trigla gurnardus* has a single large, brownish-yellow oil-globule. In the earlier condition of the periblast the cells of the blastoderm are continuous with it. The invaginated layer of the germinal ring is never continuous beneath the segmentation cavity, nor is it continuous with the periblast; it passes beneath the axis of the embryo, and from the first constitutes the dorsal hypoblast. The floor of the intestine is in all probability derived from the periblast. The whole edge of the blastoderm represents the ancestral blastopore, and the formation of the embryo by concrescence is simply the closing of the blastopore from before backwards. The edge of the blastoderm in Amphibia, Petromyzon and the ganoids is homologous with that of teleosteans but not with that of elasmobranchs. The inflected part of this edge in the latter represents the whole of it in the teleosteans. The ancestral part of the primitive streak in Sauropsida represents the ancestral blastopore, while the posterior part represents the coalesced uninflected part of the blastodermic rim in the elasmobranchs.——The fish fauna of Lake Balkhash, according to M. Nikolsky, numbers fourteen species, viz., *Perca schrenkii*, Phoxinus (two sp.), *Barbus platyrostris*, Schizothorax (five sp.), *Diptychus dibowskii* and three species of Diplophysa. All but one of these are new, and none are found either in the Aralo-Caspian basin or in the system of the Obi. Five genera are common to Lake Balkhash and the Central Asian lakes. In all these lakes Cyprinidæ and Cobitidæ predominate, and two species are common to Lob-nor and Lake Balkhash. Three species, the two Phoxini and the perch, are the only ones which ally the fauna of the latter lake to that of the Obi. From these facts M. Nikolsky concludes that if the depressions of the Alatau, Aral-Caspian and Siberia were ever a continuous marine basin, the first was separated earlier than the others.——Messrs. G. B. Goode and T. H. Bean describe sixteen new species of fishes (Proc. U. S. Nat. Mus., Oct., 1885) obtained by the U. S. Fish Commission mainly from deep water off the Atlantic and Gulf coasts. The species include five Heterosomata (Aphoristia two, Hemirhombus one, Citharichthys one, Etropus one), two species of Macrurus, one of Coryphænoides, one of Malococephalus, three of Bathgadus, one of Neobythites (nov. gen.), one of Porogadus (n. g.) and two of Bathyonus, which last name is a substitute for Bathynectes Gnthr., preoccupied in Crustacea.

Mollusks.—It appears from the experience of Mr. W. Armstrong and W. K. Brooks that seed oysters grow more rapidly and are of a better shape when placed on floating collectors than when deposited on the bottom. This is due to the absence upon these floating surfaces of the sediment which often forms a coat upon the bottom before the spat can become attached.——Those who wish to know how a list of species fares in the hands of one who critically republishes it, should look over the Report on the testaceous Mollusca obtained during a dredging excursion in the Gulf of Suez in the months of February and March, 1869, by Robert MacAndrew. Republished, with additions and corrections, by Alfred Hands Cooke (*Ann. and Mag. Nat. Hist.*, Feb. 1886).

Echinoderms.—M. G. Cotteau has put forth a preliminary but important paper upon the Eocene Echini of France, containing descriptions and figures of the species belonging to the genera Spatangus, Maretia, Euspatangus and Hypsospatangus.——Howard Ayers, as a result of studies of the structure and function of the Sphæridia of the Echinoidea, carried on at Banyul-sur-Mer (Quart. Jour. Micr. Soc., Nov., 1885), arrives at the conclusion that these organs possess the double function of taste and smell.

They are much more highly specialized than they are described by Loven to be, and have in fact a greater specialization of parts than can be seen in similar organs in the Medusæ. Sounds, which affect the spines and pedicellariæ immediately, are not noted by the sphæridia, which are first to recognize the presence of a drop of acetic acid in the water.——Mr. R. Rathbun (Proc. U. S. Nat. Mus.) contributes a report upon the Echini collected by the U. S. steamer *Albatross* in the Gulf of Mexico from January to March, 1885. Thirty-one species were collected in suitable condition for determination. These represent seventy-eight dredging stations in from twenty-one to 1330 fathoms, only one species having been obtained in shore collecting. Seventeen species were additional to those obtained in 1884, yet nine species of that date were not found in 1885.

Worms.—Dr. von Linstow (Zeit. f. wissen. Zool.) enumerates fourteen courses of development known among Nematelminths, according to the medium in which they develop. (1) Some genera pass directly into an adult form; (2) the larvæ live in the earth, the adults in plants; (3) the larvæ live in worms, and on their death pass into the earth and become adult; (4) in *Sphærularia bombi* the adults live in the earth, and the fruitful females enter the bodies of bees and there reproduce; (5) the larvæ live in the earth, the adults in some animal; (6) the hermaphrodite worm lives in some animal, while the offspring develops into bisexual forms in the earth; (7) some adults are free-living and sexual, others hermaphrodite and parasitical on animals; (8) the larvæ hatch in the earth and develop into hermaphrodite forms in animals; (9) the larvæ live in insects, the adults in earth or water; (10) the larvæ live encapsuled in one animal, and with it pass into the digestive system of another animal and become adult; (11) the hermaphrodite form lives a short time in the intestine of some animal and here produces a larva which becomes encapsuled in the muscles; (12) the adults live in the tracheæ of birds, the embryos are expectorated, swallowed with the bird's food, hatch out in the crop and œsophagus, wander into the bronchiæ and air-sacs, and thence to the tracheæ (*Syngamus trachealis*); (13) Gordius has two larval forms, one in beetles the other in mollusks, while the adults live in water; (14) of two larval forms one is aquatic, while the other inhabits the lung of an amphibian and passes thence into the intestine of the same animal where it develops into the hermaphrodite form. This is the case with *Nematoxis longicauda*, the last form of which is described and figured by Dr. Linstow.——The annelid, *Siphonostoma diplochætus*, according to M. Et. Jourdain, has two pairs of true eyes provided with a refringent body analogous to that present in tunicates, and traversed with radiating striæ. This worm is common in the mud near Marseilles, and is covered with a very thick coat of mucus derived from two types of papillæ, the one ovoid, as it were, isolated in the mucus and formed of glandular cells similar to those which enter into the structure of the epidermis, the other fusiform and with filaments at their extremity. The papillæ are joined to the body by long and slender peduncles.——F. E. Beddard (*Ann. and Mag. Nat. Hist.*, Feb., 1886) describes three species of Perichæta and one of Moniligaster from Ceylon and the Philippines. The latter genus is remarkable for the apparent absence of a clitellum and the presence of five distinct gizzards in the œsophagus.

Protozoa.—A. C. Stokes (*Ann. and Mag. Nat. Hist.*) describes several New Infusòria from American fresh waters.——H. J. Carter describes in the January and February numbers of the *Ann. and Mag. of Nat. Hist.*, thirty-five species of sponges from the neighborhood of Port Phillip heads, South Australia.

EMBRYOLOGY.[1]

On the Symmetry of the first segmentation Furrows of the Blastodisk of Elasmobranchii.—The nearly symmetrical subdivision of the blastodisk of Teleosts by the first four segmentation furrows has long been known. The details of the early development of the blastodisk of Teleosts have been very carefully elaborated by Agassiz and Whitman,[2] whose conclusions are, I believe, generally accepted by embryologists. Of the development of the blastodisk of Elasmobranchs we know comparatively little, especially in relation to the relative position and direction of the first segmentation furrows. The object of the present note will therefore be to describe the early segmentation of the blastodisk of one of the latter, viz., *Raia erinacea*, as displayed by an egg removed from the oviduct and cloaca of a female of that species, July 11, 1885, at Wood's Holl, Mass.

Upon opening the tough horny membranous envelope in which the ovum proper of Raia is enclosed, it is found that the egg is somewhat pinkish in color, and is imbedded in a layer of very glairy "white" or albumen, which fills up the space between the egg and the horny case. The pinkish egg proper is somewhat flattened and oval in shape, and is immediately invested by a very thin and delicate vitelline membrane. At one side of the flattened vitellus, which measures nearly one and a quarter inches through its longest diameter, a small circular whitish area about two millimeters in diameter is noticeable. This is the blastodisk or germinal area of authors, and is the point where development first begins to manifest itself.

If the egg case is carefully opened, the white removed and then laid into a one per cent solution of chromic acid, the blasto-

[1] Edited by John A. Ryder, Smithsonian Institution, Washington, D. C.

[2] On the development of some pelagic fish-eggs. Proc. Am. Acad. Arts and Sci., xx, 1884.

disk may be hardened *in situ* without distortion, and afterwards separated from and carefully lifted off of the underlying vitellus, together with a thin hardened flake of the latter to support it. Such was the treatment to which the blastodisk here figured and described was subjected. The surface view, Fig. 1, was drawn with the camera lucida after hardening, and the section shown in Fig. 2 was drawn from one taken at about the position of the line *a* in Fig. 1. Cleavage had already advanced so far as to subdivide the area of the blastodisk into fifteen sharply defined cells, so that it may be assumed that this blastodisk has nearly completed its sixteen-celled stage of development or that the fourth cleavage is about completed.

A comparison of the first four cleavage planes of this blastodisk shows that they are formed in very nearly the same order and relation to each other in Elasmobranchs as in Teleosts. For example, the first plane I, in Fig. 1, has cut through the originally circular blastodisk and caused it to become elongated at right angles to the direction of the first segmentation furrow exactly as in the eggs of teleostean fishes. The second furrow, II, cuts the first at right angles so as to further subdivide the first two cells into four. The next cleavage is caused by two nearly parallel furrows, III, III, which appear simultaneously, and further subdivide the cells of the blastodisk into eight. The fourth cleavage is caused by two parallel furrows, IV, cutting the blastodisk approximately at right angles to the two furrows of the third cleavage. It thus results that sixteen cells will be developed, and it will be apparent also that the method of segmentation thus indicated is exactly comparable with that characteristic of the developing ova of teleosteans. We have, in fact, the same elongation of the blastodisk in one direction as is produced by the first segmentation furrow in the latter. The same oblong, squarish outline of the blastodisk as observed in the sixteen-celled stage of teleostean development is also obvious, and it is also evident that such a squarish configuration of the blastodisk does not disappear until the morula condition is reached or at least approximated, just as in Teleosts. These data serve to show that the features of segmentation as observed by several investigators in the eggs of Teleosts are repeated with no essential variation in the de-

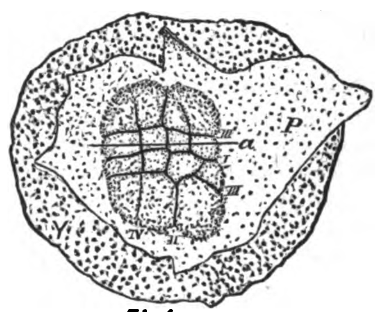


Fig. 1


Fig. 2

velopment of the eggs of the Elasmobranchs. The subdivision of the blastodisk into cells in both types of Ichthyes is essentially a symmetrical one, determined by the first cleavage plane. Whether or not the first cleavage plane of the ovum of elasmobranchs coincides with the median plane of the future embryo, as supposed by Whitman, Roux, Pflüger and E. Van Beneden, it is impossible to decide at present, but it would seem not at all improbable that such might be the case.

A series of sections of this blastodisk of Raia, prepared by the aid of a Cambridge rocking microtome, which was presented to the U. S. Fish Commission by Professor Adam Sedgwick, have enabled me to reach some interesting conclusions in reference to the structure of the blastoderm of the Elasmobranchii during its one-layered condition. At this stage the four median or central cells are not completely sundered from the underlying periblast, P, Fig. 2, since the cleavage furrows are found to terminate abruptly before they have quite cut through the finely granular plasma of the blastodisk proper, as shown in Fig. 2. In this respect the cleavage of the blastodisk of Elasmobranchs differs very decidedly from that of teleosts as described by Agassiz and Whitman in the paper already cited.

The germinal plasma of the disk is composed of a clear substance in which very fine granules are imbedded. These granules are probably of the same nature as the crystalloids or tabular crystal-like rigid bodies which largely enter into the composition of the yolk Y. In fact a careful examination reveals the fact that the very finely granular plasma of the segmenting blastodisk passes by insensible gradations into that of the yolk charged with very coarse granules or tablets. An exceedingly thin envelope of finely granular plasma, which is continuous with the margin of the blastodisk, covers the entire vitelline mass. This is represented by the irregular outline of the area P in Fig. 1, below which lies a discoidal mass of coarsely granular yolk, Y. In Fig. 2 the relations of the cortical layer P, or periblast, to the vitellus are still more distinctly shown, and it is very evident that the plasma of the blastodisk is continuous inferiorly with the vitelline mass, and that a cleavage cavity must be developed at a considerably later stage.

The lower limits of the segmentation furrows were very sharply defined, as shown in Fig. 2, and the nuclei of the constituent cells of the blastodisk were observed as clear round or oval areas in the plasma of the cells, and near the center of each one could be seen a very well marked nearly globular chromatin body, which occasionally was observed to be provided with irregular processes which extended outward into the nuclear space. No karyokinetic phenomena were observed.

From what has preceded it does not seem at all probable that the "free nuclei" which are finally developed under the blastodisk of Elasmobranchs originate spontaneously. It is indeed far more likely that they originate by a process of segmentation in which the marginal cells of the blastodisk are involved the same as in Teleosts. Such a view is in fact supported by fig. 15 given in Balfour's Comparative Embryology, Vol. II, p. 34, in which two free nuclear spindles are shown at the edge of the deeper-lying part of the blastodisk of Pristiurus in the morula condition, consisting of four superimposed rows of cells. Balfour's figure also shows that between the lowermost cells composing the blastodisk and the coarsely granular vitellus there is still a considerable unsegmented stratum of finely granular plasma interposed. In this lower layer of finely granular plasma alone the "free nuclei" are found, thus furnishing additional evidence that the view expressed above as to the origin of such nuclei is probably correct. In the disk of Raia examined by me the cleavage planes are also marked by the clear margins of adjacent cells, as in the blastodisk of Pristiurus figured by Balfour. The blastodisk of Raia here figured and described measured 1.71 millimeters in width and 2.37 millimeters in length. Its thickness in the center was about .6 of a millimeter, and thinned out at the margin into a very thin layer of plasma which is obviously homologous with the cortical or periblastic layer of the teleostean egg. Later stages of the blastodisk of Raia show it subdivided into smaller and more irregular cellular areas; the whole disk also again assumes much more nearly the original discoidal form characteristic of it previous to the beginning of segmentation. To judge from the condition of the blastodisk here described, it of course is to be inferred that the fertilization of the egg takes place while it is still in the oviduct, or possibly even before it enters the latter.—*John A. Ryder.*

PHYSIOLOGY.[1]

Glycogenic Function of the Liver.—I see that in your general notes on Physiology in the April number of the American Naturalist, p. 397, an abstract is given of Professor Seegen's researches on the glycogenic function of the liver. One of his most important conclusions is that peptones are destroyed in the liver by being split into liver-sugar and a nitrogenous residue. Now this is exactly the conclusion at which I arrived in my paper, "On the glycogenic function of the liver," published eight years ago.[2] In that paper I say (p. 102): "Therefore—and this is a very important point—*albuminoids are decomposed in the liver into glycogen and some nitrogenous matter* which is excreted partly in the bile but probably mostly restored to the blood to be excreted as urea by the kidney. In this way excess of albuminoid over and above what is necessary for build-

[1] This department is edited by Professor Henry Sewall, of Ann Arbor, Michigan.
[2] *Am. Jour. Sci.*, Vol. xv, p. 99, 1878.

ing is reduced to a condition suitable for combustion." I do not pretend to put my results, founded entirely on general reasoning, on the same footing as the careful researches and experiments of Professor Seegen, but it seems to me so explicit a statement deserves recognition.

Again Professor Seegen draws attention to the fact that fasting animals still continue to make liver-sugar and that therefore this function *is continuous*. In the same paper I state that waste tissues being albuminoid are undoubtedly eliminated in the same way, *i. e.*, by splitting in the liver into a carbo-hydrate *which is burned* and an incombustible nitrogenous residue to be eliminated mostly by the kidneys. The researches of Schiff[1] demonstrate that waste tissue undergo some important, yea necessary, change in the liver, but as to the nature of the change he says nothing. If the disposal of waste is connected with sugar making, as I affirm, this fact entirely explains the continuity of the function.

Again Professor Seegen says: "The formation of peptones (at least in carnivores not growing) is mostly to form sugar." I say, "The whole albuminoid-excess is split into sugar to be burned for vital force and vital heat and an incombustible residue to be otherwise eliminated, *i. e.*, the whole albuminoid-excess is utilized as sugar."

As to the experiments of Professor Seegen and others showing that with carbo-hydrate diet the sugar in the portal vein is less than in hepatic vein, I confess they are wholly unintelligible to me. What becomes of the sugar which is absorbed in such large quantities? Is it not possible that it may be present in some form which does not respond to the ordinary tests for glucose?

The final conclusion of Professor Seegen that *glycogen* always present in the liver *is not the source of liver-sugar*, must be established on very firm basis before it will be accepted by physiologists.—*Joseph LeConte.*

BERKELEY, CAL., *April 8, 1886.*

PSYCHOLOGY.

MEYNERT'S PSYCHIATRY,[2] VOL. I.—This volume of 285 pages is largely devoted to the gross and minute anatomy of the brain. Besides the appendix on the mechanism of expression, and a short chapter on the nutrition of the brain, two-thirds of the book are devoted to anatomy and one-third to the physiology of this important organ. The work represents the results of Meynert's researches up to 1884, and is of first-class value as embracing the

[1] Arch. des Sciences, Vol. 58, p. 203, 1877.

[2] Psychiatry, a clinical treatise on diseases of the Fore-brain. By Theodor Meynert, M.D., professor of nervous diseases and chief of psychiatric clinic of Vienna. Translated by B. Sachs, M.D. Vol. I. New York, G. P. Putnam's Sons. 8vo, 1885.

descriptions of a master in cerebral anatomy and physiology. The text is accompanied by mostly excellent engravings, which are so necessary to the comprehension of this abstruse subject. We give some of these, Figs. 1, 2 and 3 (Nos. 9, 24 and 56 of the book) which represent structure, and Fig. 4 (60) which illustrates the law of muscular action under stimulus.

Meynert opens his chapter on the physiology of the brain with the assertion (p. 138) that it is an organ of which the function may be inferred from its structure. This inference is justified by facts of physiology both normal and abnormal. The most important normal physiological law which is adduced in evidence,

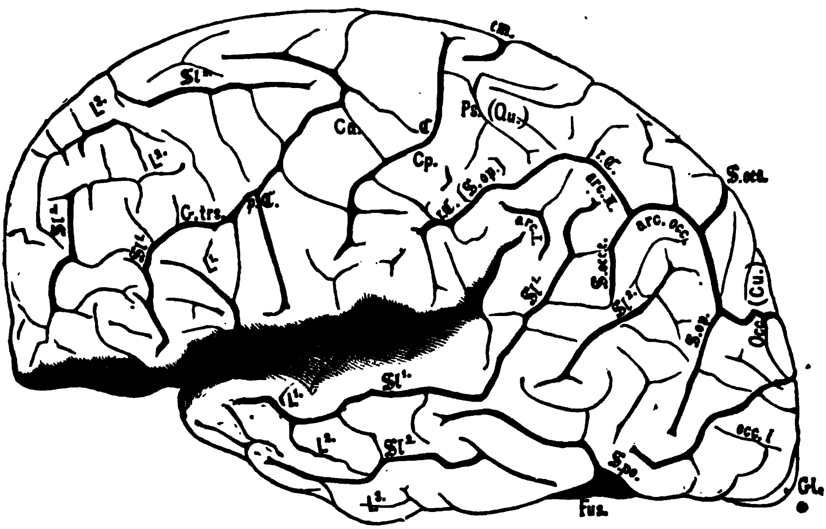


FIG. 1.—Convexity of the human brain. *J*, island of Reil; $\mathfrak{FS}$, sylvian fissure. The letters are placed on the temporal lip of the fissure; above the island lies the operculum, bounded by the anterior ascending limb, which passes upward toward the letters $\mathfrak{Sl}'$, and the posterior ascending limb approaching the lettering *arc. I.* $\mathfrak{C}$, central fissure; $\mathfrak{pC}$, præcentral fissure (anterior radial fissure); $\mathfrak{rC}$, ($\mathfrak{S.op}$), post-radial fissure (sulcus occipito-parietalis); $\mathfrak{S.occ}$. occipital fissure; $\mathfrak{Sl}^1$, $\mathfrak{Sl}^2$, longitudinal fissures in frontal and temporal lobes; $\mathfrak{Sl}^1$, designates below parallel fissure; $\mathfrak{S.po}$, præoccipital fissure (fus gyrus fusiformis); *Ca*, anterior central convolutions; *Cp*, posterior central convolutions; *Ps* (*Qu*), superior parietal lobe (lobus quadratus); *arc I*, *arc II*, inferior and superior parietal convolutions; $\mathfrak{S.occ.e}$, external occipital fissure (ape fissure); *Cu*, *Occ*, *Occ i*, the three occipital convolutions of Ecker; *Cu*, indicating the convex surface of the cuneus, and *Occ i* designating the convex surface of the gyrus lingualis; *Gl*, *em*, callosomarginal convolution; *arc.occ*, occipital arch; L^1 L^2 L^3, above $\mathfrak{FS}$, frontal convolutions.

is that of Bell, "that the conduction of nerve force is in a centripetal direction through the posterior, and in a centrifugal direction through the anterior spinal roots." That cerebral function has definite locations is demonstrated by three facts among many others. The first of these is the intimate relation observed to exist between the size of the olfactory lobe and the sense of

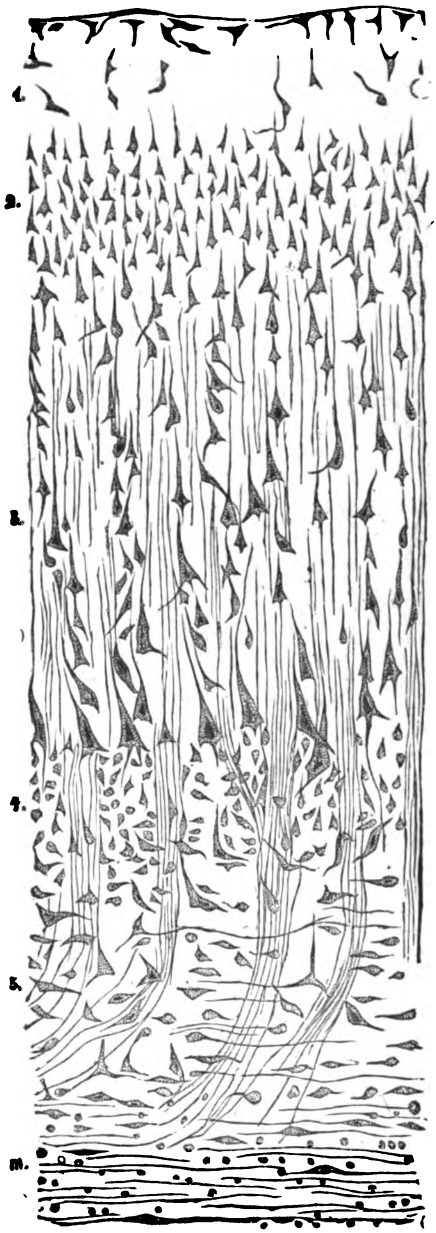


FIG. 2.—Section through the third longitudinal convolution of the frontal lobe adjoining a fissure. The fine layer type of the cerebral cortex. 1, superficial layer of neuroglia; 2, layer of small pyramids; 3, layer of large pyramids ("formation of the cornu ammonis"); 4, the granular layer; 5, the layer of spindle-shaped cells ("claustral formation"); *m*, medullary substance of the convolution.

smell; the second, the close relation between the size of the olfactory lobes and the gyrus fornicatus, with which its fibers connect. This convolution is greatly developed in Mammalia with strong olfactory powers, forming with the external olfactory convolution the very extensive convexity of the cornu ammonis; thirdly, the direct connection which exists between diseases of the region about and within the sylvian fissure, especially the claustrum, and disorders of the faculty of speech. The experiments of Hitzig, Nothnagel, Ferrier and Munk receive due attention, and their curious results are given in detail.

Dr. Meynert's definition of the *ego* is interesting as proceeding from the physiological standpoint. He says (p. 16): "The sum of these [innervation] centers constitutes the 'individuality,' the 'ego' of abstract psychologists. I attach some importance to

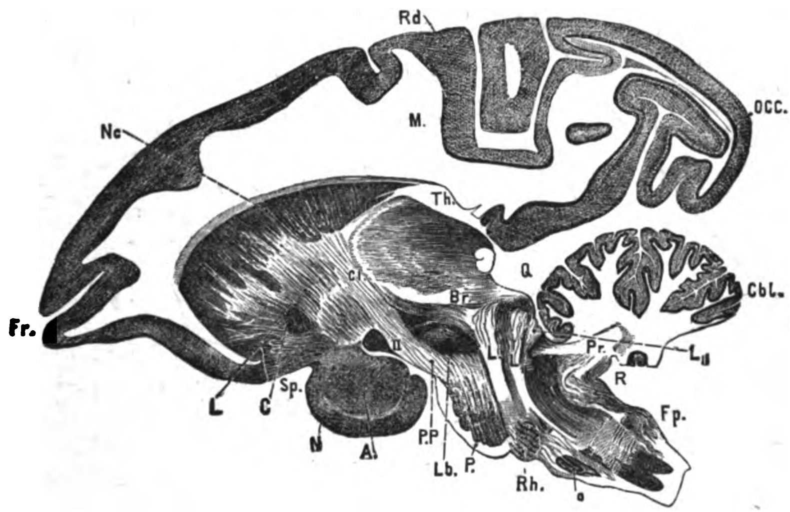


FIG. 3.—Transparent longitudinal section through the brain of a monkey. *Fr*, frontal end; *occ*, occipital end; *Rd*, cortex cerebri; *M*, medullary substance of the fore-brain; *Nc*, caudate nucleus; *L*, lenticular nucleus; *C*, anterior commissura; *N*, globus pallidus; *A*, amygdala; *II*, optic tract; *C.I*, internal capsule; *Th*, thalamus; *Br*, brachium corporis quadrigemini; *Lb*, discus lentiformis (by mistake of the engraver united to the stratum intermedium. The dark-pointed triangular mass in front of it is the radiation of the posterior longitudinal fasciculus. Underneath *Br* the radiation of the nucleus ruber); *L* L_{I} L_{II}, lemniscus of the superior and inferior corpus bigeminum, and of the valvula cerebelli; *P.P*, pes pedunculi; *P.* pons varioli; *Rh*, corpus rhomboideum; *O*, inferior olive; *Cbl*, cerebellum; *Pr*, processus cerebelli ad cerebrum; *R*, corpus restiforme; *Fp*, funiculus posterior.

the word 'individuality' because it is founded upon the anatomical structure of the cortex, and the simple physiological process which enters into our present discussion. Individuality implies the sum of firmest associations which under ordinary circumstances are well nigh inseparable; the aggregate of 'memories' forming a solid phalanx, the relation of which to conscious movements can be defined apparently with mathematical precision. This unequal activity of the fore-brain, constituting individuality, varies as regards contents and degree with each person; it is designated

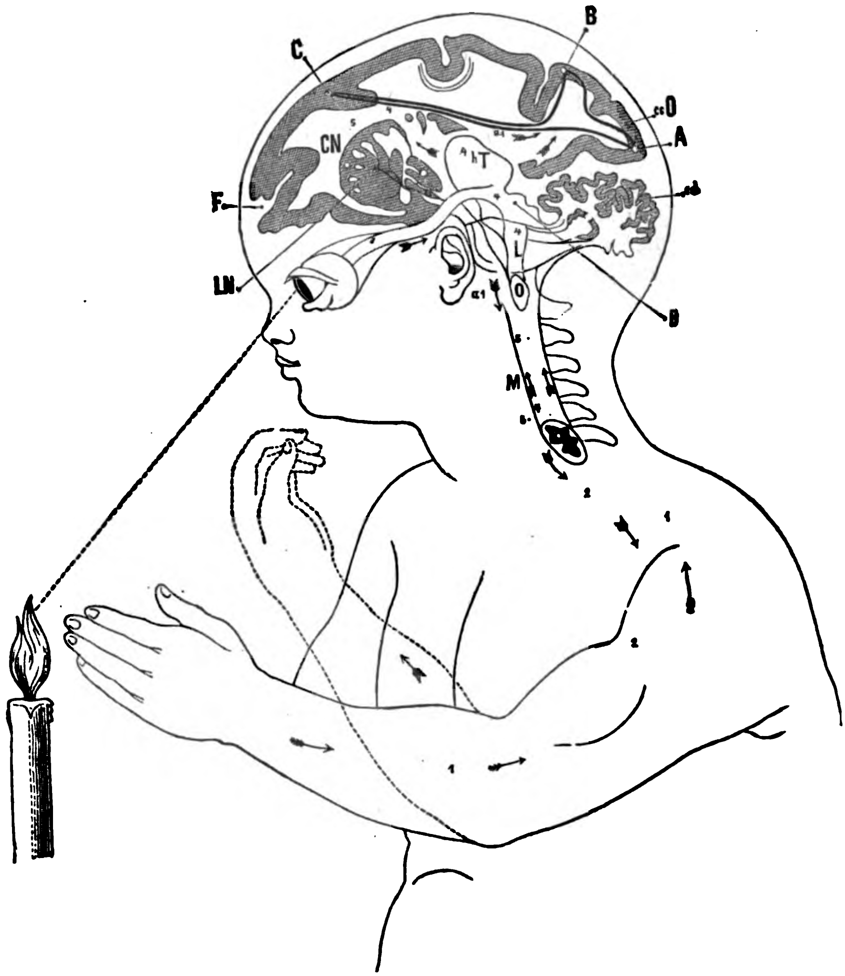


FIG. 4.—Diagram explaining the mechanism of a conscious movement of the arm. *F*, frontal cortex; *ccO*, occipital cortex; *C.N*, nucl. caud.; *L.N*, nucl. lenticularis; *hT*, thalamus opticus; *D*, mesen cephalon; *L*, pons variolii; *O*, med. oblongata, characterized by the olivary body; *M*, medulla spinalis, terminating with a cross-section of the cervical spinal cord; *cd*, cerebellum, blue lines indicate centripetal. red lines centrifugal tracts, the red and blue circles in the spinal cord and fore-brain denote central gray nuclei, black lines mark the association fibers; *IaI*, sensory tract of the arm; *B*, part of the cortical center for cutaneous sensation; *2*, tract for effecting the movement of the arm; *3A*, conducting tract of the optic nerve: *A*, part of the visual center; *4C*, tract conducting sensation of innervation interrupted in the thalamus; *C*, a center in the cortex for sensations of innervation; *5*, centrifugally conducting tract originating in the cortical area *C*.

also as the character of each individual. It has been justly observed that if the character (individuality) of a person were entirely known, we would be able to predict the thoughts and deeds of such an individual, however complicated they might be."

On p. 170 it is pertinently remarked, that "there is no gap between conscious and reflex movements to be filled in by instinct."

Dr. Meynert makes the following reference to the nature and value of our cognitions (p. 183): "I wish to add that it is the boldest hypothesis, shared alike by the ordinary mind and by scientific realism, to assume that the world is such as it appears to the brain to be; that the latter can be likened to a mirror which simply reflects the forms of the outer world; that the world as it appears to the brain exists independently of the presence or absence of mind. Indeed, it seems to me to be a crucial test of an individual's power of thought to determine whether he can conceive or not of the unreality of the world clad in forms which our minds have bestowed upon it. It should be reiterated that the idealistic conception of the world is supported by physiological facts, and still more positively by the facts of cerebral architecture before alluded to." We cannot learn from this paragraph whether Dr. Meynert is an idealist in the Berkeleyan sense or not. In any case the pathological argument has a double edge. Perceptional and ideational incapacity, based on pathological conditions, no more prove the unreality (*i. e.*, immensurability) of the *non ego*, than the perfection of our cognitions enables us to perceive all there is of the world. Because we do not apprehend all, it is not to be inferred that we therefore apprehend nothing.

Dr. Meynert promises to discuss the important question of hereditary predisposition to mental disease in the second part of the work. He outlines his position on this question in the preface to Vol. I in the following language: "It is taking altogether too simple a view of things to regard morality as one of man's talents and as a definite psychical property which is present in some persons and lacking in others."—*C.*

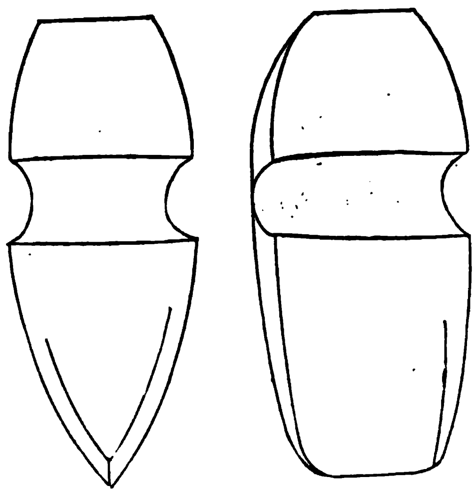
ANTHROPOLOGY.[1]

THE ABORIGINAL AX OF THE SALT RIVER VALLEY, ARIZONA.—The fertile alluvial lands of the great valley of Salt river, which have been lying idle for unknown centuries, are now being rapidly redeemed by irrigation and planting. Phœnix, the "Garden City" of Arizona, now numbers some 5000 inhabitants, and is rapidly growing in population and wealth upon the ground which was formerly densely occupied by a race presumably extinct, unless it finds representation in the Pimos and Maricopas of to-day.

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

Amongst the relics of the past turned up by the modern plough the aboriginal stone ax is the most conspicuous and abundant. The numerous specimens show that but one general form and type prevailed, and that the material in all was nearly the same—a compact, firm, dark-green dolerite. Availing doubtless of the river-worn boulders nearest to the desired form, the ancients shaped them by rubbing or grinding into axes of superior form and finish, capable of doing good service in cutting and hewing the soft cottonwood trees of the lowlands and even the harder mezquite of the first terrace where their homes were built.

The form of the ax is best described by the accompanying figures, in side view and top view. The groove or channel for



the withe or thong of rawhide for the handle is generally deep and left somewhat rough in surface, while the rest of the ax is ground smooth and is polished. In some specimens, however, the groove is also smooth and polished as if by long wear. This groove extends across the top of the ax and down the two sides, but not across the bottom, or under edge, which is left straight and is ground smooth, apparently for the reception of a key or wedge to tighten the clasp of the thong on the stone. In many specimens particularly in the heavy hammers or sledges, also found here, the borders of the groove are raised in a ridge a quarter of an inch or more above the general surface, thus giving a broader and firmer bearing for the thong while the blade and head of the ax are made smaller and thinner.

The thickness of the axes varies considerably, as also the length, due in part to wear by long use and repeated grinding.

The weight seldom exceeds three pounds, and the length eight to ten inches.

One double-bitted ax, an unusual form, is seven inches long and one and a quarter inches thick. It is well shaped and appears to have been an effective tool. The cutting edges of all the axes were formed with great care and are curved as in our modern axes. They bear indisputable evidence of careful grinding into shape and to a cutting edge. This grinding was done with great accuracy and skill. The rectilinear parallelism of the lines of abrasion is surprising. Evidence of the use of stone axes is found in the remnants of the cedar floor beams in the walls of the ruins of Casa Grande.—*Wm. P. Blake, Phœnix, Arizona, March, 1886.*

THE SO-CALLED DEFORMED CRANIA.[1]—The discovery in Cuba of a series of crania commonly called deformed Carib skulls, is itself an argument against this identification, for it is well known that there never were either Caribs or practices of deformation in Cuba. M. le Docteur Montané read before this society, at a former meeting, an essay entitled, "A Cuban Carib," an epithet as opposed to the opinions of the author of the present paper as, for example, a Jamaican Aztec, a Venezuelan Quichua, a Portuguese Basque or a Magyar Englishman.

Let us establish who are the Caribs and under what circumstances were the crania found?

The Caribs, according to P. Casas and other chroniclers of America, were the inhabitants of Guadeloupe and Dominica, the first islands that opposed the Castilians. Christopher Columbus gave them the name, confounding them with the Chalybes of Asia, warlike people, neighbors to the Amazons, dwelt upon by the geographers and historians of antiquity.

These Caribs belonged to the same race as the other inhabitants of the archipelago, with no other difference except wearing the hair long and eating human flesh. This last accusation, unproved, extended later to other peoples of the continent belonging to different races. The word Carib became the synonym of anthropophagy, and there were Caribs throughout America, in Mexico, the Antilles, Brazil, &c. The first to bear this name disappeared a few years after, quicker than their relatives in other islands. War, slavery, and their own aggressive wars more promptly resulted in their extermination. In fact, half a century after the discovery of America, Guadeloupe, Dominica and adjacent islands were deserted. A new race of Indians established itself there and the land was occupied by France and other powers.

Thus the Indians called at the end of the seventeenth century Caribs by Breton, Du Tertre, Rochefort and Labat, and who,

[1] Read in Spanish before the Anthropological Society in Havana, Nov., 1885.

according to Rochefort, came from Florida (an incredible theory), and according to other authors from South America, were not the descendants of the first-named inhabitants of the archipelago. The authors named above depict their Caribs with racial characteristics quite different from those of the race anteriorly described by the first conquerors. Their language, according to Breton, had nothing in common with that familiar to Columbus and his companions. They were, moreover, much mixed with the negroes of Saint Vincent and Tabago, forming a race commonly called Carib negroes.

The opinions advanced in this study are related especially to the true and ancient Caribs of Columbus and the first chroniclers.

The plaster cast before us was taken from one of a number found, in 1847, in a cave near the eastern end of Cuba, by Miguel Rodriguez Ferrer, whose explorations, writings and official measures have contributed so much to scientific studies in our island. Two of these crania are now in Havana, where they were studied by the learned Poey; two others were sent to Madrid, where they were studied by MM. Graells, Vilanova and Peres Arcas; others remained in the possession of the discoverer. The original of this cast belonged to the University of Havana, and was destroyed by fire. Fortunately Sr. Nicolas Gutierez had preserved a perfect reproduction in plaster, which he presented to the Society of Anthropology.

The cranial measurements of Sr. Montané although useful, and indeed indispensable in other craniological studies, have no importance when we have to prove or disprove an historic fact as definite as the usage attributed to the Caribs and other American savages of voluntarily changing the form of the head. Craniological measures are useful in determining the characters of a large series or in deciding whether a given skull belongs to a class well known. But M. Montané does not possess the dimensions of a single series of crania called deformed Carib; what is more he has not the measures of one such. If such data existed they would be found in the best known texts, but we search for them in vain. Neither in public or private museums nor in atlases have we a single example of a deformed Carib skull. Only one has been described under this head in Morton's Crania Americana from a cast in Philadelphia, the original of which existed in Paris and had been used by Gall and Spurzheim in their phrenological studies.[1] But notice that this came from the Island of St. Vincent, the principal home of the Carib negroes. Moreover, this skull has not been measured by any modern methods, or at least Dr. Montané does not give them.

On the contrary, there is at Charleston a veritable Carib skull

[1] Dr. Moultrie, quoted by Morton, "Physical Type of American Indians," in Schoolcraft, "Archives," II.

from Guadeloupe; but, notice well, it is not flattened but, quite the contrary, very high in the crown, a decisive proof against the justice of the classification generally called "deformed Carib."

Finally, there are at Paris several other crania coming from the Lesser Antilles called Carib, which have been measured by modern methods. But, mark well, they are not deformed; that is to say, Dr. Montané does not possess the measurements of a single deformed Carib cranium.

Consequently he undertakes to discover resemblances between this and crania from Ancon, in Peru. He reports the measurement of two types of these the deformed and the non-deformed. The figures published in his work, if they prove anything, demonstrate that the skull in question is not Carib at all but of the non-deformed from Ancon, Peru.

On the contrary the report of M. Graells, Vilanova and Perez Arcas, signed by a large special committee of the Museum of Madrid relates to the two crania discovered by Sr. Ferrer.[1] The authors do not hesitate to recognize the resemblance between the two skulls before them and those generally called deformed Carib. They declare that a complete study of the question of artificial flattening is impossible without a numerous series of the same form. They close by saying that in relation to the two crania before them, they do not believe that there had been deformation but that the shape is natural.

Sr. Felipe Poey, who examined at Havana, about twenty years ago, two crania found by Sr. Ferrer, believed that one of them was perfectly natural. Sr. Rodriquez Ferrer himself did not believe them to be Carib, relying mainly upon the belief that we had never had Caribs in Cuba. Indeed, they never came in their excursions further than Porto Rico, or at least than Santo Domingo, they never flattened the skull, and finally their crania were not of the form which they had been supposed.

In 1512 an abandoned vessel was discovered on the coast of Guanimar, south side of Cuba. No trace of its crew was afterward found. Peter Martyr, from his library in Spain wrote that they were devoured by anthropophagous savages.

On the contrary Las Casas says: "This has not the slightest appearance of truth. No one has been able to prove that the Caribs—if there are any such people—have ever traveled so far from their islands, which are Guadeloupe and Dominica, situated far to the east of San Juan (Porto Rico). I believe that they land at l'Espagnole (Saint Domingo) only now and then. Those who speak like Peter Martyr take their fancies for realities."[2]

The phrase, "if there are any," applied to the Caribs would appear a little strange from the pen of such a great authority.

[1] Report presented at Madrid, March 24, by Srs. Graells, Vilanova and Perez Arcas.

[2] Casas, Historia de las Indias. Madrid, 1875, III, 484.

Casas had no faith in the charge of anthropophagy made against the Indians by the conquerors of the new world, an accusation which he attributed to a desire for a pretext to enslave the savages.

Still more strange is it that neither Casas nor any other of the earlier historians speak of the Indians called Caribs as applying to the heads of their infants apparatus to change the form—an ominous silence when we consider that these same writers are full of detail, false or true, relative to these same savages. In a word, Columbus, Chanca, Americus Vespucius, Bernal Diaz, Peter Martyr, En Ciso, Ferdinand Columbus, Las Casas, Oviedo, Gomara and many others for a century and a half after the discovery are unanimously silent about the artificial deformation of the cranium attributed in later times to the early inhabitants of the Lesser Antilles.

If the first witnesses and chroniclers on America are mute regarding deformation, they describe with great exactness the heads of the indigenes of these islands, and the result is that the skulls are very elevated in the crown.

The most ancient and authoritative of these witnesses, Christopher Columbus,[1] declares that the inhabitants of the Antilles, the Greater and the Lesser, and those of Terra Firma, resemble one another in respect to their natural form, with wide foreheads and heads well elevated.

There were not in the Antilles the two races as alleged, but one uniform race without variation of physical characters. This is so true that when, after ten years of exploration in the archipelago and the northern part of South America, Christopher Columbus arrived at the Island of Guanaja and the countries of Central America, where he found forms of head quite different from those which he had formerly seen, he recorded this fact in his notes.

Americus Vespucius,[2] who saw the same Indians on the islands as well as on the coast, compares their visages with that of the Tartars, who have the forehead very wide.

Doctor Chanca[3] asserts that the only difference among the Indians of these isles consisted in the pretended wearing long hair by the Caribs and the wearing by the women of a kind of cotton bands around the legs above and below the calf.

Bernal Diaz,[4] who never lived in America, but who saw at Seville some hundreds of Indians sent to be sold under the unjust accusation of being eaters of human flesh, many of whom he lodged in his own house, says the Caribs have the same physical conformation as others. "They are not more deformed than others, only they have this evil custom. In all the islands there

[1] F. Colon. Vida del Almirante, cap. 89. Casas. Historia, III, 109, 113.

[2] Premier Navigatum.

[3] Chanca. Lettre au Municipe de Seville, Jan., 1494. Coll. de Navarrete, I, 353, 358.

[4] Bernal Diaz. Historia de los Reyes Católicos, cap. 118.

is no difference either in the form or the manners of the inhabitants, nor in their language. All have the face and forehead long, the head round, with the same distance between the temples as from the forehead to the occiput."

We may affirm then, in virtue of this testimony, that the primitive Caribs had no habits of deformation, and that their heads, instead of being elongated and flattened as was supposed, were round and elevated.

Oviedo[1] was the first to start the report of the existence of voluntary deformation in America. In his edition of 1535 he says that the inhabitants of St. Domingo had the forehead very wide on account of certain manipulations, "For at the moment of birth they press the forehead and the occiput of children."

Such treatment would not effect a permanent change in the form of the head.[2]

Gomara[3] expresses himself in parallel terms in relation to Saint Domingo, only he specifies that it was the wise women to whom was due the shape of the head in these Indians. He adds, regarding the Indians of Cumaná, that the pressure made at the moment of accouchment was effected by two bundles of cotton. Gomara was never on American soil.

Las Casas[4] says that in Peru it was a great privilege granted to certain chiefs whom they wished to honor to give to the heads of their infants the form of those of the king and princes of the royal family.

From this we conclude that the practice was neither obligatory nor general, nor practiced upon the heads of the royal family. Moreover Casas was never in Peru. On the contrary he knew Saint Domingo better than did Oviedo, but says not one word concerning the heads of the inhabitants of that island. He knew Central America better than did Oviedo, and though he mentions practices attributed to mothers or wise women, deformations of the skull have no place.

It is Cieza de Leon[5] who commences to speak vaguely of wooden apparatus applied to the heads of Indians. He says that among the Chancos, in the province of Quimbaya, and in other regions they compress the heads of new-born babes with tablets which are replaced later on by ligatures.

It is astonishing that with respect to the Caraques, near Manta, by Quito, the operation is reversed, first the bandages and then the tablets, which in his opinion remain four or five years in place. But he knows only indifferently the countries of which

[1] Oviedo. Historia general y Natural de Indias, II, cap. 5; XLII, cap. 3.

[2] Topinard. Elements d'Anthropologie generale. Paris, 756.

[3] Gomara. Historia de las Indias. Madrid, 1852, 172, 206.

[4] Casas. Apologetica Historia, cap. 34, 392.

[5] La Cronica del Perú, cap. 26, 378, 1853. Madrid. Also cap. 50, 404; also cap. 45, 399.

he speaks, as himself avows. As to Peru proper, he mentions the deformative process only among the Collas, saying nothing of Cuzco, Lima and other places in the empire. Moreover this author is one of the most credulous of his time.

Finally, Garcilaso[1] reports that the Indians of Manta, by Quito, deform the heads of their children by means of two tablets which they tighten more and more every day during four or five years. He says that in Tula, or Florida, the same result was attained by means of certain ligatures which they used nine or ten years. But Garcilaso visited neither of these countries. Cabeza de Vaca lived ten years in Florida, describes many customs of the Indians, but makes no mention of deformation. As to Quito, Garcilaso evidently copies Cieza.

It is with relation to Peru proper, where he was born and where he lived up to his twentieth year, that Garcilaso is an authority of the first order. He says not one word of deformation among the Collas nor of any place in the empire of the Incas. It is improbable that he would have omitted an operation so common and one practiced on his own head, if it had existed. Moreover he describes what is done to infants at the moment of birth and during lactation. Instead of the compression of the head, either by the hands, or by bandages, or by tablets, the head is left entirely uncovered and is never touched, particularly near the brain, while the body and arms are securely wrapped.

There are many other narratives of the conquest, but in none of them is there the least confirmation of the statement as to cranial deformation. Human nature is so prone to receive without examination extraordinary statements, that the ball of snow of voluntary deformations in America attained colossal proportions. That which began by being credited concerning three or four regions wide apart, finishes by being extended over the entire continent.

A century and a half after the extinction of the Caribs from the Lesser Antilles, we find other savages in the same islands, in regard to whom the voyagers of their time have repeated all the stories, false or true, that the first Spanish conquerors told concerning various Indian populations.

It has been said that this absurd practice endured long after the conquest, and that it was forbidden by order of the Spanish government, according to others by the decisions of a council of Lima, according to others by a papal decree. The Marquis de Nadaillac affirms that the council in question was held in 1545; but M. Topinard believes that it took place in 1585, and that in 1752 the governor of Lima published a new edict against deformations. Now, there were no councils held in Lima in 1545 and 1585. The five councils held there took place in 1551, 1567,

[1] Garcilaso de la Vega. Comentario reales de los Incas, IX, cap. 8; La Florida del Inca, IV, cap. 15; Comentarios, IV, cap. 12.

1583, 1591 and 1601. The decisions are preserved, and there are not the slightest allusions to deformation.[1]

Rivero and Tschudi[2] visited a large number of Peruvian tombs, examined the mummies in them, among others a fœtus of seven months old, still in the mother's womb, many children of all ages, and of adults, and having observed throughout the same cranial form, without the least vestige of depression nor of deforming apparatus, they came to the conviction that this was the natural form of the head.

M. Robertson[3] examines no less minutely the platicephalic crania of the mound-builders of the United States, supposed to be deformed, and the analysis convinced him that the crania were natural.

We have seen in a former citation that according to Casas the heads of Guatemala Indians deformed in times anterior to the discovery, had given rise by inheritance to crania spontaneously deformed. According to other witnesses the same thing took place among the Omaquas of South America.[4] The practice having been attributed to these savages by Ulloa, an affirmation repeated in 1754 by Unarte, it results that this form of head is at present perfectly natural and that "Children come into the world in this tribe and some others with the head dislocated."

The same result follows concerning the three races of Peru that exist at this moment with the same form of head that they formerly had, without any need of deformatory practices. In the words of Rivero and Tschudi:[5] "But there is one proof still more conclusive against the usage of mechanical means; it is the actual existence of three races, in distinct although contracted areas, where we find no trace of bandage nor of pressure exercised on the head of the new born.

It is then demonstrated there is neither historic, scientific nor rational base for the affirmation that in Tropical America there were countries where the head was modified in form by mechanical means. Nature by its own forces was entirely equal to the task of producing then and producing to-day these same forms in many parts of the world.

This truth is still more evident in relation to the savages, called Caribs, of the Lesser Antilles; first, because none of the earliest chroniclers attribute to them a similar habit, and secondly, because no one has found the form of head that has been attributed to them.—*Juan Ignacio de Armas.*

[1] Leyes de Indias; Solerzano, Politica Indians; Hernaez, Coleccion de Bulas Breves, y ottos Documentos relativos a la Iglesia de America y Filipinàs. Bruxelles, 1879.

[2] Rivero et Tschudi. Antiquida des Peruánas. Vienna, 1851, p. 52.

[3] S. Robertson. Les Mound Builders. Cong. Internat. d'Américanistes. Luxemburg, I, 43.

[4] Sobron. Los idiomas de la America lateria. Madrid, 106.

[5] Rivero and Tschudi, *op cit.*

MICROSCOPY.[1]

An Alcoholic Drip for the Thoma-Jung Microtome.—As is well known, sections of many hardened specimens may be readily made without imbedding by simply fastening them in the holder of a microtome, with or without cork, pith, etc., for support. Trial sections of moderate thinness thus made often prove surprisingly useful. Decalcified bone, cartilage, kidney, and many other *hardened* animal tissues may be examined with great despatch, while stems, roots, and other fairly rigid portions of plants also give excellent results. This simple method generally demands, however, that the object shall be constantly flooded with strong alcohol, and the same necessity exists always in the use of celloidin, which we have found to be an imbedding material of great utility, especially in vegetal histology. For the Schanze and other microtomes, in which the object is raised without any lateral movement, a simple siphon, consisting partly, at least, of rubber

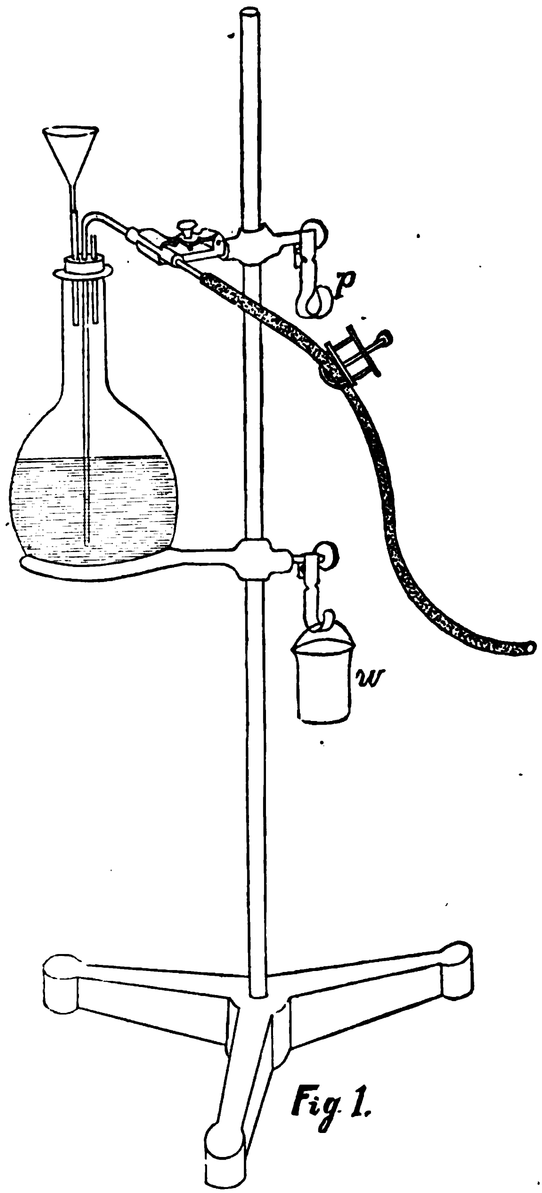


Fig. 1.

[1] Edited by Dr. C. O. Whitman, Mus. Comparative Zoology, Cambridge, Mass.

tubing, upon which is placed a common screw-clamp for regulating the outflow, supplies a dripper which is effective and quickly home-made in any laboratory. For the Thoma microtome it is also available, either by flooding the knife when this is set slanting and pushed clear of the instrument, or by frequent readjustments to compensate the progress of the object up the inclined plane. Either of these expedients, however, involves objections which are avoided by the use of the simple apparatus here figured.

Constant pressure and flow are secured by the siphon which is

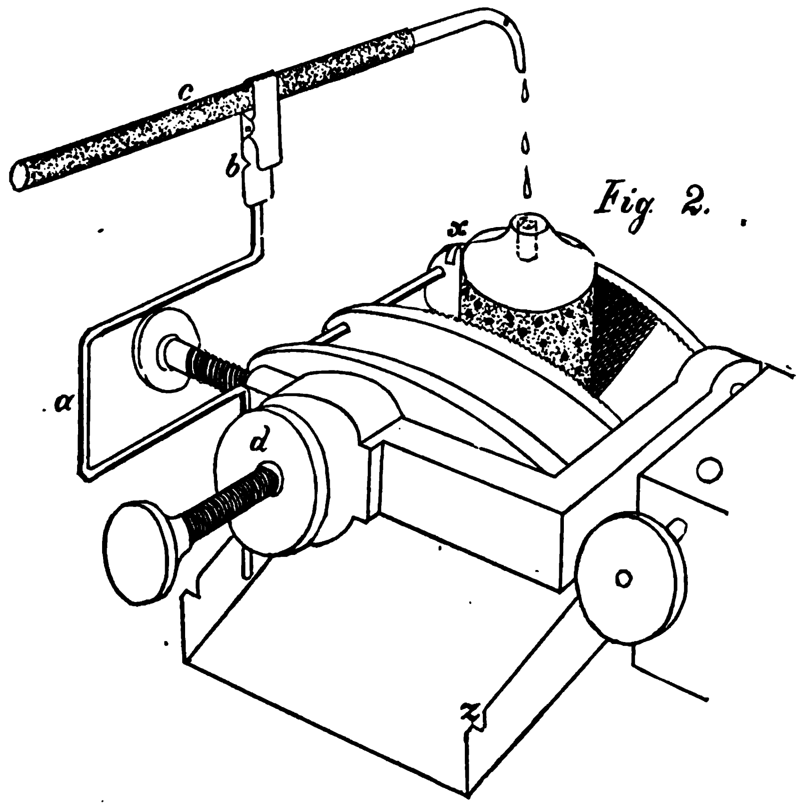


Fig. 2.

obtained conveniently as in Fig. 1. The stopper of the flask or bottle may, of course, be omitted, but in the figure it has three holes: one for the siphon-tube, one for a small funnel, and one for the exit of the vapor when alcohol is poured in through the funnel.

For use with the Thoma microtome the end of the flexible siphon-tube is attached to the object-holder in such a way as to travel with it, and hence over the object, wherever it goes (Fig. 2). This is done by means of a bent (or straight) stiff wire (*a*), to the top of which is soldered a clipp or grip (*b*), which embraces the end of the siphon-tube (*c*), as shown in the figure, and gives adjustment by allowing the dripper to be pushed back or forth. Instead of the wire and clip a "sleeve-holder" having a long shank may be used, after merely straightening out and twisting the shank. Attachment of the wire to the object-holder is secured by the collar (*d*), which is screwed down firmly upon the wire and gives at the same time a second and valuable adjustment about a vertical axis. To carry off and save the alcohol a copper or tin trough is used, and is shown in Fig. 3. It may be readily made by "bending up" a thin flat piece of the metal, and

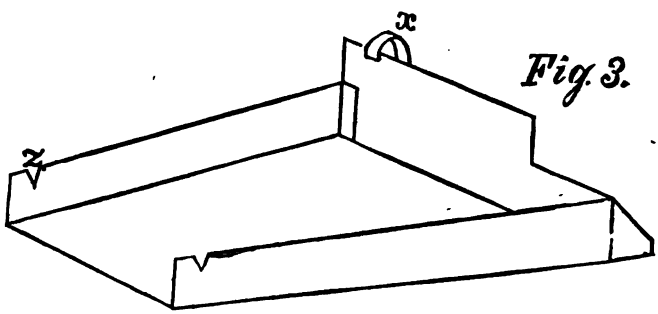


Fig. 3.

is completed by the addition of a small hook (*x*) of the same material, though this may be dispensed with. The trough fits underneath and behind the object-holder, as shown in Fig. 2, the hook *x* serving to hang it (Fig. 2, *x*). The notches, *z z*, in the trough are for a loop of wire or string passing about the neck of a beaker (Fig. 1*w*), which is thus carried underneath, catches the alcohol, and is occasionally emptied into the siphon-flask. When not in use the siphon-drip and the wire are removed by loosening the collar (Fig. 2, *d*), and are hung as one piece upon the bull-dog hook (*p*, Fig. 1). In the devising and constructing of the apparatus I have been constantly aided by my friend and pupil, Mr. G. E. Stone, who has also made the accompanying drawings. —*W. T. Sedgwick.*

SCIENTIFIC NEWS.

— The Audubon Society.— The Audubon Society (named after the great naturalist), founded last February, is rapidly increasing its membership in all parts of the country. The purpose of the society is to prevent—(1) The killing of any wild bird not used for food. (2) The taking or destroying of the eggs or nests of any wild birds. (3) The wearing of the feathers of wild birds. The office is at 40 Park Row, New York.

The society wishes a local secretary in every town and village to secure signers of its pledges; and will upon application furnish circulars of information and pledge forms. Upon the return of the signed pledges certificates of membership will be issued. Beyond the promise contained in the pledge no obligation nor responsibility is incurred. There are no fees, no dues, nor any expenses of any kind. There are no conditions as to age.

The promoters of the movement are sanguine of effecting a great change of sentiment relative to the destruction of our songsters and insect-destroying birds for hat decoration.

——:o:——

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

National Academy of Sciences, April 20–22, 1886.—The following are the titles of the papers read at the session:

The geologic age of the Equus fauna. By G. K. Gilbert.

The Cowles electrical furnace. By T. Sterry Hunt.

On the phylogeny of the Batrachia. By E. D. Cope.

On the phylogeny of the placental Mammalia. By E. D. Cope.

The comet of Biela. By H. A. Newton.

Areas of high barometric pressure over Europe and Asia. By Elias Loomis.

The cockroach in the past and in the present. By S. H. Scudder.

On the diathermancy of ebonite and obsidian, and on the production of calorescence by means of screens of ebonite and obsidian. By Alfred M. Mayer.

On the coefficient of expansion of ebonite. By Alfred M. Mayer.

On the determination of the cubical expansion of a solid by a method which does not require calibration of vessels, weighings, or linear measure. By Alfred M. Mayer.

On measures of absolute radiation. By Alfred M. Mayer.

On the geology of the region near Zacualtipan, Hidalgo, Mexico. By E. D. Cope.

On ancient and modern methods of arrow release. By Edward S. Morse.

The ordinal and super-ordinal groups of fishes. By Theo. Gill.

On the absolute and relative wave-length of the lines of the solar spectrum. By H. A. Rowland.

Platinous compound as additive molecules. W. Wolcott Gibbs.

Influence of magnetism on chemical action. By Ira Remsen.

Upon the deaf and dumb of Martha's Vineyard (continuation of research relating to the ancestry of the deaf). By Alexander Graham Bell.

On the invisible spectra. By S. P. Langley.

Cretaceous metamorphic rocks of California (by invitation). By G. F. Baker.

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THE MAKING OF MAN.

BY CHARLES MORRIS.

FOR a period of many millions of years—how many not even conjecture can decide—the world of vertebrate life continued quadrupedal, the seeming deviations therefrom being rather apparent than real. Suddenly a true biped appeared. For a period of equal duration the mentality of animals developed with excessive slowness. Suddenly a highly intellectual animal appeared. The coming of man indicated, both physically and mentally, an extraordinary deviation from the established course of organic development. Both physically and mentally, evolution seems to have taken an enormous leap, instead of proceeding by its usual minute steps; and in the advent of the human species we have a remarkable problem, whose solution is as difficult as it is important.

It might be solved in a moment were we able to accept the arguments of those who hold that man is the outcome of a distinct act of creation, and is invested with powers and qualities, and prepared for a destiny, in which from the beginning he has stood apart from all other living beings. Yet these arguments no biologist of our day can accept. It has become clearly apparent that the points of distinction between man and the lower animals are simply of degree, not at all of kind, and that both physically and mentally man comes into close contact with the lower forms of life. They do not only touch, they are intimately interwoven. There is an intricate net-work of structural relations which binds man inextricably to the realm of lower life. This realm is not alone the basis on which he rests. It is the soil from which he has sprung, and into which he is so deeply rooted that not the hand of a god could tear him loose.

It is not our purpose here to give any of the arguments in favor of this conclusion. They may be found fully presented elsewhere. We design rather to endeavor to trace the line of ascent of man from the lower animal world, and to seek to discover to what combination of highly favorable circumstances his development is due.

Physically man does not deviate very greatly from the mammals next below him. His method of locomotion is essentially changed, but structurally he is very closely related to the higher apes. Yet so much are all living beings the creatures of circumstance, that it seems possible, and even probable, that the remarkable mental differentiation of man may be a necessary result of this comparatively slight physical differentiation. His erect attitude, with certain variations in his life-habits which directly arise from it, bring him into new relations with surrounding nature, and these new relations have certainly very much to do with the new conditions which have arisen within him. A single step may lead at times to a vast train of unexpected consequences, and such seems to have been the case with this new step in evolution made by man.

Man is the only true biped. He has but two points of support, while all other animals are supported at four or more specialized points, or else rest on the general surface of the body. In birds, for instance, which are usually considered bipeds, the wings are organs for aërial support, and have no other function. The nearest approach to man in this respect, among existing animals, may be found in the forms which progress by jumping, such as the kangaroo. Yet in these the structure and function of the fore limbs is distinctly locomotive. And such was probably the case with the dinosaurian reptiles of a past geological era, despite the fact that they seem to have been able to walk, to some extent, on their hind limbs alone.

It is certainly remarkable that, in the whole extended period of animal life, no single vertebrate form appeared, so far as we can discover, before the advent of man, in which the fore limbs were completely freed from duty as organs of support and became structurally unfit for this duty. A partial freedom in this respect would be of minor value, since the formation necessary to locomotive duty must be retained, and the development of any new functional power would be checked. Thus in this respect man is an anomaly in the kingdom of life. And to this anomalous feature is quite probably due in very considerable measure the peculiar character of his development.

It is very evident, indeed, that the full adoption of the erect attitude gave man an immense motor supremacy over the lower animals; for it completely released his fore limbs from duty as organs of support—for the first time in the known history of vertebrate life. They were set free to be employed in new methods and to develop new functional powers, to which the grasping function, which man inherits from the ape tribe, was an invaluable aid. It is to the possession of two limbs which are freed from any organic duty other than attack and defense, and which are adapted to grasp weapons and tools, that man owes his enormous advantage over the lower animals. It opens to him possibilities which do not exist beneath him. All the forces of nature are at his command, as soon as he can learn to control them. The first club or spear he grasped, the first missile he threw, inaugurated a new era in the history of life, and opened the way to man's complete mastery. And, so far as we can perceive, this important structural advantage preceded the development of his mental superiority, and gave the cue to it.

In the vertebrate class below man, there exists but a single animal form that possesses a limb which is free from duty as an organ of support. This is the elephant, whose nose and upper lip have developed into an enormous and highly flexible trunk, with delicate grasping powers. The possession of such an organ has undoubtedly had its share in the marked intellectual development of the elephant. Yet this organ is far inferior in its powers to the hand and arm of man, while the form, the size and the habits of this animal stand in the way of its gaining the full results which might arise from the possession of such an organ in connection with a better adapted bodily structure.

As to the evolutionary processes through which man gained the peculiar features of his structure, we have interesting evidence in the existing forms of life. In one type of life, and one alone, can we perceive indications of a gradual variation from the quadrupedal towards the bipedal structure. This is the ape type, or rather that of the lemurs and apes in conjunction. In all other mammalian types the aspect of the body is distinctively horizontal. Life in trees does not necessarily produce a deviation from this horizontal aspect, since it is retained by all arboreal mammals except those just mentioned. Yet it offers an opportunity for such a deviation, and this opportunity has been improved by the lemurs and apes. Their hands have developed a grasping power which is possessed by no other arboreal animal, and which opens to them new motor possibilities. They may assume a semi-erect or a fully erect attitude, by grasping upper branches with the hands. And this ability, in the higher apes, has led to the development of a mode of progression on the ground which is more or less intermediate between the quadrupedal and the bipedal modes.

This fact is of great interest, as it seems to lead us directly towards the development of the bipedal habit, as attained in man. Though such a habit may be partly attained by tree-living animals, a residence on the ground is essential to its full development. And it is significant, in this connection, that no existing apes have fully given up the arboreal habit.

Of the anthropoid apes, the orang and the chimpanzee dwell habitually in the trees. On the ground they are out of their true element. The same is the case with all the species of the gibbons. All these creatures move with some difficulty on the ground, but freely and easily in the trees. The gorilla, on the contrary, seems to dwell more habitually on the surface. Its great weight tends to render an arboreal life unsuitable, and its hand is not so well adapted to climbing as that of the chimpanzee. Yet it has only in part given up its arboreal residence. It ascends trees for food and, to some extent, to sleep, though there is some reason to believe that the adult males sleep occasionally, and perhaps habitually, on the ground. It seems to be in a transition state between the arboreal and the surface life-habit.

Of the lower apes, the baboons make the ground their usual place of residence. They have not lost their climbing power, however, but can ascend trees with ease and rapidity. Most of the other apes dwell wholly, or nearly so, in the trees.

This fact of the partial or complete arboreal habit of all existing apes is of importance in this connection. It prevents any of them from attaining the peculiar structural development of man. The mode of progression best adapted to a life in trees is opposed to the erect attitude of man, and this attitude could not be fully gained except by a species which dwelt wholly on the ground. And life in trees absolutely requires the use of the arms as locomotive organs, and prohibits that freeing of them from this duty which exists in man. When man ascends trees he is obliged to return to the habit of his ancestors and use his arms as organs of progression. It seems evident, therefore, that if man descended from the apes his ancestral species must have been a form which had fully given up its life in trees, and had become almost as awkward in climbing as man now is, ere it fairly began to change from ape into man.

The adoption of a surface residence by any ape would necessitate certain changes in structure. Tree-dwelling apes, when they descend to the ground, present us frequently with an awkward compromise between the horizontal and the vertical modes of motion. Neither of these modes is natural to them, and to become properly adapted to either some change of structure is necessary. Many of them progress in the true quadrupedal manner, and in one ground-living tribe, the baboons, the structure of the body has suffered an accordant change. They have become true quadrupeds.

In other cases there is an inclination towards an erect mode of motion. Even among the lemurs this is occasionally displayed. Some species of these progress on the ground by jumps, the body being semi-erect and the arms held above the head. The anthropoid apes all have a curious mode of progression on the ground, intermediate between the erect and the horizontal methods. The orang, the chimpanzee and the gorilla alike use their four limbs in progression, but in a manner very unlike that of ordinary quadrupeds. They swing the body in a curious fashion between the arms. It is a sort of half-jumping, half-walking motion. Resting the body on the hands, the animal swings itself between the arms, and moves forward by a quick succession of such lifts and swings. In this movement the orang and the chimpanzee bring their closed knuckles to the ground, but the gorilla is said to keep the hand open and apply the palm to the ground. The outer edge rather than the sole of the foot touches the ground. The whole movement is as awkward as is that of man when he attempts to climb trees, and seems to indicate that there can be no satisfactory compromise between the two life-habits. A surface-dwelling animal must tend to become either a quadruped or a biped, The actual result in all these cases seems to depend largely on the comparative length of the arms and legs. All the three species named have shorter legs and longer arms than man, and can thus readily lift their bodies upon their arms while in a semi-erect attitude. Yet they all are obliged to incline the body forward in movement. This is less the case with the gibbons, the extreme length of whose arms enables them to reach the ground with the hands without bending the body. Thus the gibbons can walk on the four limbs with the body erect.

Certain species of the gibbon can readily walk erect on their legs alone by balancing themselves with their arms. They often do so, and can even move tolerably fast, the body rocking from side to side. But if urged to speed they drop their long arms to the ground and progress in the swinging fashion. Of the other forms there is no satisfactory evidence that the orang ever walks erect, though it may be able to assume the erect attitude when attacked. Mr. Savage says that the chimpanzees are sometimes seen walking erect, the body bent forward, with the hands clasped over the occiput to balance. But on the appearance of danger they immediately take to all fours to fly.

The gorilla seems more inclined to walk erect, or rather in an inclined position, the body bending forward, with the head hung down. And it stoops less, when on all fours, than the chimpanzee, since its arms are longer. When walking it balances its huge body by flexing its arms upwards. Its gait is a rolling one, from side to side. When attacked it seems to always assume the erect posture. In structural formation it is better fitted to the erect attitude than is the gibbon.

The subject here considered is of considerable importance in its relation to the evolution of man. We observe various phases of tendency towards the biped habit, and can readily perceive that the walking gibbons or the gorilla might in time become true bipeds if they should completely give up their arboreal residence. The length of the arms is an important element in this problem. In all the species mentioned the length of the arms differs, but in all it is longer, as compared with the body and legs, than in man. The species from which man descended, with its longer legs and shorter arms than in the existing anthropoid apes, could not, without the greatest difficulty, have adopted their swinging mode of motion. Nor could it advantageously have assumed the quadrupedal habit, as in the baboon, whose four limbs are nearly equal in length. It was forced towards the bipedal habit by sheer necessity. On taking the ground surface for its place of residence, it was probably obliged to walk erect as the only movement to which its structure was well adapted. Neither the quadrupedal nor the semi-quadrupedal movement would have been suited to the proportions of its limbs, and its ancestral movement in trees may have been more vertical than is common with apes. Its bipedal development may have begun while it was still arboreal.

This erect posture once fully assumed and the arms thus completely freed from duty as organs of support, the animal, yet an ape, would have had an advantage of the greatest value over its fellow apes, and over all other members of the animal kingdom. Nearly all quadrupeds use their limbs to some extent in attack and defense. Yet the necessity of resting on these limbs interferes to a certain extent with this duty. In the animal in question the duty of locomotion being confined to the hind limbs, the fore ones were completely set free to be used as weapons. And to this power was added that very important one of their peculiar adaptation to grasping, which enabled the creature to add greatly to its natural strength by the use of missile and other weapons.

This advantage has not been confined to man and his progenitors. The power of the grasping function in this direction is of service to many of the apes. The story of the cocoanut-flinging monkeys does not need to be repeated. And it is equally well known that the orang, when attacked, will break off fragments of branches and shower them to the ground in a rage. But in all such cases there is nothing to indicate any precision of aim. The throwing seems to be done at random. It is probable that the arm has to be educated to the proper use of missiles, and that to gain this function it must be freed from other duties.

There is no positive evidence that any apes use weapons except in this manner. The story is told that the chimpanzee will wrest the spear from the hunter and use it against him. But this story needs to be verified. Also the common picture of the orang walking erect and supporting itself with a staff is entirely imaginative. Nothing of the kind was ever seen in nature. The teeth seem the main dependence of these creatures for purposes of defense. They will break off limbs and twigs and make themselves beds with great rapidity, but this seems the utmost limit of their constructive powers.

As for the animal from which man descended, it must have quickly gone further than this in the use of artificial weapons and in the arts of construction. Possibly its first assumption of the erect attitude may have been aided by the use of a staff, and if so, this would naturally be employed as a club or a spear on occasion. Through uses of this kind the arms would gradually become educated to their new duties, and gain facility in important movements which were impossible while they were forced to retain their locomotive adaptation.

This line of argument need not be carried further. It is evident that we have here the beginning of a new course of development whose end is yet in the future. The freedom of the arms and hands from the duty of support, their grasping power, and the use of artificial weapons and tools, were unquestionably main elements in the evolution of man. For under such circumstances the employment of artificial instruments would naturally be progressive. There would be no limitation to this progress from the necessity of using the arms for other duties, and such structural limitation as may have originally existed must gradually have disappeared, through increasing performance of and growing adaptation of the arms and hands to these new duties. The use of clubs in attack and defense, and of stone missiles for the same purposes, might readily have been adopted by an ape so constituted, and modern archæologists do not hesitate to trace all subsequent development in the arts to just such a simple beginning. Rudely chipped stones are found as early weapons of primitive man. Naturally shaped stone weapons undoubtedly preceded them.

Whether one or more species attained this bipedal development is a question not easily settled. It is almost certain that there was one only. Yet, if so, variations in the structure of this original biped must have taken place at an early date, possibly ere it became a full biped and began to strongly resist the molding influences of nature, if we may judge from the essential structural differences between the principal races of mankind.

Yet highly favorable as was the structural development of the original man, it needs no extended consideration of the subject to perceive that in this we have but one of the factors to which he owes his supremacy. The freeing of the arms to the performance of new duties was an essential agent in any rapid mental development. Yet it was not the only agent. The mental development of man began in the mental development of the apes. It is but the completion of a process which extends much further back than the beginning of the human era, and through which, in one type of life, the mammalian intellect attained an exceptional unfoldment. Human mental progress began at the high level attained by the anthropoid apes. To the causes of the unfoldment of the ape intellect some attention is therefore due.

There is nothing in an arboreal residence in itself to specially promote mentality. The squirrels and other arboreal quadrupeds are not of a high intellectual grade. Undoubtedly the activity, the variety of motions, and the grasping power of the monkeys must have aided in their mental unfoldment, yet we find that the lemurs, with the same general organization and life-habits, are intellectually dull. For the inciting element to the development of the ape intellect, therefore, we must look further.

Among the lower life forms the Carnivora are more intellectual as individuals than the Herbivora. Yet as groups the latter occasionally display intellectual conditions far higher than anything attained by the solitary Carnivora. These instances of intelligence are only found among the social species, and are displayed most remarkably in the communal classes, the ants, bees and beavers.[1] Yet even in these the purely plant-feeding bees fail to display the great variety of intelligent acts of the partly carnivorous and actively belligerent ants. It would appear, therefore, that while the activity and cunning arising from carnivorous habits aid in the development of individual intelligence, it is equally aided by social habits, and that a combination of these two requisites presents the most favorable condition for high progress in intelligence.

In fact, if we consider fully the ants, we find that these minute creatures, with none of the advantages in structure over their fellows possessed by man, have advanced politically and industrially to a level which was not reached by man until after he had dwelt for ages upon the earth. And, so far as all indications point, this exceptional development is due to social or communal

[1] See Communal Societies, *Popular Science Monthly*, Jan., 1886.

influences alone. It appears, therefore, that social combination is a highly essential agent in intellectual development, quite as important as, perhaps more important than, any special advantages in structure and individual habits.

The solitary life of cats, spiders, &c., while aiding to develop mentality in individuals, prevents the transmission of useful ideas. Only instincts are transmitted. Ideas die with their originators. On the other hand, the communal habits of ants and bees, while highly adapted to the preservation of useful ideas, tend to hinder individual excursions of mind and the rapid growth of ideas. An ant community is a society of strict specialists. The best condition for intellectual progress would seem to be an intermediate one, in which complete individual activity exists, yet in which social links are closely drawn, so that ideas may be transmitted by education and observation, as well as instincts by heredity. And to the fullest utility of this condition some degree of carnivorous habits would seem essential. It needs no intellectuality to gather fruit from the trees. It needs often the highest exercise of cunning to capture animal prey, while it produces a variety of perilous and exciting situations to which the strict vegetarian is not subjected.

Among modern apes socialism exists in various degrees. The lemurs display but little socialism. Some species of monkeys display it in a high degree, and it is a general characteristic of the family. Mutual aid in danger is common, education is not wanting, combination in enterprises is frequently observed, and probably through these and the like influences, observation and imitation have been developed to a degree not seen elsewhere among the Mammalia. Yet so advantageous is social combination in promoting intelligence, that the high degree of cunning displayed by baboons, in posting sentries while robbing fruit plantations, is but a fuller development of a similar habit possessed by several species of otherwise dull social animals.

Among the existing anthropoid apes, however, the social habit is greatly lacking. The orang, the chimpanzee and the gorilla are more or less solitary in their habits. The orang is particularly so, and is never seen in groups of more than two or three. The chimpanzee and the gorilla are somewhat more social, yet not markedly so. The groups of the gorillas appear to be polygamous bands, since they never possess more than one adult male, the rest of the band being composed of females and young. There is more evidence in favor of the chimpanzees combining in larger groups, yet this does not appear to be their usual habit. Reade remarks that both these species, without being gregarious, sometimes seem to assemble in large numbers. Unfortunately very little satisfactory information is possessed as to their habits in a state of nature.

These large apes are also strictly vegetarian. They lack the incitement to intellectual development arising from carnivorous habits. On the whole, then, their marked powers of intellect are somewhat surprising. It is probable, if we may judge from the habits of the lower monkeys, that the anthropoids descended from social species, and have in part lost their social habits. This is also indicated by the fact that the young of these anthropoid apes seem more inclined to socialism than do the adults. It is also shown in the higher socialism of the gibbons, the existing representatives of the primitive anthropoids.

If we seek, then, for the ancestors of man in the family of apes, we must look for a species possessed of several essential requisites, all of which can be found in no existing apes. These requisites, as considered in the preceding pages, may be briefly summarized.

The ancestor of man must have been of sufficient size and weight both to render continued life in the trees inconvenient and to give the necessary strength to combat with the perils of a surface life. His strength, indeed, must have been sufficient, combined with his cunning, to make him a match for the larger animals. He must have been aggressive as well as defensive, and if not originally carnivorous must have become so in a degree. Strictly herbivorous habits would have tended to check mental development.

Second, and yet more important, was the assumption of an erect attitude, and of a true biped structure, with the complete freeing of the fore limbs from duty in locomotion. There naturally followed upon this an increase of that use of missiles already possessed by the apes, with an advancing skill in the use of artificial weapons as the arms became adapted to this new function. With this came that dominance over the lower animal world which has been so essential a feature in the progress of man. And with it began his still increasing control of the energies of nature.

To these physical conditions must be added the social one. The ancestors of man could not have been solitary in their habits, but must have been strongly social. It is possible that the solitary condition of the existing great apes is a result of their strictly vegetarian habits. An anthropoid with carnivorous tendencies and original social habits would tend to increase rather than to lose these habits, through the great benefit derived from mutual aid in conflicts with the larger animals. That man, at an early period in the stone age, waged war with the largest animals, we have satisfactory evidence in the results of archæological discovery.

The original human society must have been one of mutual aid, combination in enterprises, some degree of language, or of the use of sounds conveying warning and information, protection and education of the young, and habits of observation and imitation. All these exist in some tribes of monkeys. As to vocal powers, the gibbons possess them in a high degree, though there is no evidence to show that any existing apes have specialized sounds to convey special information. It is to a group of the higher apes which possessed these characteristics in an unusual degree that we must look for the ancestors of man. If we be asked for traces of such a group we can but point to man. The ancestral line has vanished in that of its descendants. The existing anthropoid apes are but side issues in the problem.

The development of the social condition and of the educational process must have had a vigorous influence in the enlargement of the brain. In man the dividing line between the physical and the mental powers, as organizing agents, was finally passed. A tribe had arisen, for the first time in the long history of animal life, that trusted more to its mind than to its muscles, and which had begun to substitute artificial for natural tools and weapons. With the attainment of this condition there was taken the first decided step in that long line of mental progress which has produced the brain of man. In all preceding ages evolution had been mainly physical, and exerted its chief influence upon the limbs and muscles. Now, for the first time, mental evolution gained the supremacy, and development centered itself in the brain, the organ of the mind, while the body, in great measure, ceased to change.

Under these circumstances there is nothing very surprising in the fact that the human brain has attained an exceptional development, or that its growth was strongly marked at a very early date. How far it has increased in size over that of its non-human ancestor, we cannot judge from comparison with the brains of any existing apes, since these may be of a much lower grade of development. They are probably not fair standards of comparison. And if the body stood almost unchanged for ages, and all the influences of nature centered themselves upon the brain, a considerable increase in size and some variation in structure were inevitable consequences, and it is not easy to perceive, under the circumstances, that there is anything extraordinary in the special growth of the human brain.

In the making of man, then, we perceive the critical step that took the animal world over the dividing line between physical and mental evolution; and in human development we are concerned, not with the maturity of an old, but with the infancy of a new evolutionary process, which is full of far-reaching and extraordinary possibilities, of which the intellectual progress yet attained by man may be but the beginning. There may be needed as many millions of years for the full development of the mind as have been consumed in the evolution of the body, and the organ of the mind may yet attain an importance in the scheme of the physical organism of which we have no conception.

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REVIEW OF THE PROGRESS OF NORTH AMERICAN INVERTEBRATE PALÆONTOLOGY FOR 1885.

BY J. B. MARCOU.

THE year which has just passed shows a marked increase in the number of palæontologic articles. The tendency to publish new species without any illustrations is also diminishing, and those interested in the science can look with great satisfaction on the augmented activity of North American invertebrate palæontology.

T. H. Aldrich gives "Notes on the Tertiary of Alabama and Mississippi, with descriptions of new species," and "Notes on Tertiary fossils, rare, or little known," in the Jour. Cincinnati Soc. Nat. Hist., Vol. VIII, pp. 145 and 153. "Observations upon the Tertiary of Alabama" appeared in the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 300.

H. M. Ami has a "List of fossils from Ottawa and vicinity," and "Additional notes on the geology and palæontology of Ottawa and vicinity," in the Ottawa Field Naturalists' Club Trans., Nos. 5 and 6, Vol. II, p. 251.

Francis Bain and (Sir) J. W. Dawson have a joint paper, "Notes on the geology and fossil flora of Prince Edward island," in the *Canadian Rec. Sci.*, Vol. I, p. 154.

C. E. Beecher publishes a "List of the species of fossils from an exposure of the Utica slate and associated rocks within the limits of the city of Albany," in the 36th Rep. New York State Mus. Nat. Hist., p. 78.

W. R. Billings describes "Two new species of Crinoids," and gives the "Report of the palæontological branch" in the Ottawa Field Naturalists' Club Trans., No. 6, Vol. II, pp. 248 and 259.

N. L. Britton has an article on the discovery of "Cretaceous plants from Staten Island" in the Trans. N. Y. Acad. Sci., Vol. V, p. 28.

N. L. Britton and Arthur Hollick have an article on "Leaf-bearing sandstones on Staten Island, New York," in the Trans. N. Y. Acad. Sci., Vol. III, p. 30.

Charles Brongniart has "Les Insectes Fossiles des Terrains Primaires, Coup d'œil rapide sur la faune entomologique des terrains paléozoiques," in the Bulletin de la Société des Amis des Sciences Naturelles de Rouen, 3ᵉ serie, Vingt et unième année, 1ᵉʳ semestre, p. 50. This article was translated in the *Geol. Mag.*, new series, Dec. 3, Vol. II, p. 481.

R. E. Call writes "On the Quaternary and recent Mollusca of the Great basin, with descriptions of new forms;" this constitutes Bulletin 11 of the U. S. Geol. Survey.

P. H. Carpenter prints "Further remarks upon the morphology of the Blastoidea" in the *Ann. and Mag. Nat. Hist.*, 5th ser., Vol. XV, p. 277. This is an answer to and a criticism of Mr. G. Hambach's article entitled, "Contributions to the anatomy of the Pentremites, with descriptions of new species," in the Trans. St. Louis Acad. Sci., Vol. IV, p. 145.

J. M. Clarke gives "A brief outline of the geological succession in Ontario county, N. Y., to accompany a map," in the Report State Geologist for 1884, p. 9. In this he gives lists of fossils occurring in the different Devonian formations. Bulletin U. S. Geol. Survey, No. 16, is "On the higher Devonian faunas of Ontario county, New York."

E. W. Claypole has an article "On the vertical range of certain fossil species in Pennsylvania and New York" in the AMERICAN NATURALIST, Vol. XIX, p. 644.

J. C. Cooper has an article "On fossil and sub-fossil land shells of the United States, with notes on living species," published by the California Academy of Sciences, pp. 235–255.

W. H. Dall notices the "Miocene deposits in Florida" in *Science*, Vol. VI, p. 82. He has also "Notes on some Floridan land and fresh-water shells, with a revision of the Auriculacea of the Eastern United States," in Proc. U. S. Nat. Mus., Vol. VIII, p. 255. In Bulletin of the U. S. Geol. Survey, No. 24, is a "List of marine Mollusca, comprising the Quaternary fossils and recent forms from American localities between Cape Hatteras and Cape Roque, including the Bermudas."

J. D. Dana has a note on "Lower Silurian fossils at Canaan, N. Y.," in *Science*, Vol. VI, p. 283.

N. H. Darton has a "Preliminary notice of fossils in the Hudson River slates of the southern part of Orange county, N. Y., and elsewhere," in the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 452.

G. M. Dawson, in the Bull. Chicago Acad. Sci., Vol. I, No. 6, p. 59, has an article entitled, "Boulder clays. On the microscopic structure of certain boulder clays and the organisms contained in them."

(Sir) J. W. Dawson has "On Rhizocarps in the Paleozoic period;" "Notes on *Eozoön canadense;*" "The Mesozoic floras of the Rocky Mountain region of Canada;" and "Ancient insects and scorpions," in the *Canadian Rec. Sci.*, Vol. I, pp. 19, 58, 141 and 207. He has also "A modern type of plant in the Cretaceous," and "A Jurasso-Cretaceous flora in the Rocky mountains," in *Science*, Vol. V, pp. 514 and 531. "The Cretaceous floras of Canada," in *Nature*, Vol. XXXIII, p. 32; and "Sir William Dawson on the Mesozoic floras of the Rocky Mountain region of Canada," in the AMERICAN NATURALIST, Vol. XIX, p. 609, are abstracts and notices published in advance from the author's essay "On the Mesozoic floras of the Rocky Mountain region of Canada," in the Trans. Roy. Soc. Canada, Vol. III, Sect. IV, p. I.

S. W. Ford has a "Note on the age of the slaty and arenaceous rocks in the vicinity of Schenectady, Schenectady county, New York," in the *Amer. Jour. Sci.*, 3d ser., Vol. XXIX, p. 397.

W. F. E. Gurley describes some "New Carboniferous fossils" in Bulletin No. 2 of his own series; no illustrations accompany these descriptions.

James Hall has published a large number of papers, some of which have appeared in limited editions in previous years, but they have not yet been noticed in these reviews. He publishes a "Note on the intimate relations of the Chemung group and Waverly sandstone in Northwestern Pennsylvania and Southwestern New York," and a "Note on the Eurypteridæ of the Devonian and Carboniferous formations of Pennsylvania, with a supplementary note on the *Stylonurus excelsior*," in the Proc. A. A. A. S., Vol. XXXIII, Part II, pp. 416 and 420. In the 2d Geol. Surv. Pennsylvania, Rep. of progress PPP, p. 23, he has a "Note on the Eurypteridæ of the Devonian and Carboniferous formations of Pennsylvania." In the Rep. State Geologist for 1881, p. 8, there is a "Classification of the Lamellibranchiata." In the Rep. State Geologist for 1882, p. 5, there is a "Discussion upon the manner of growth, variation of form and characters of the genus Fenestella, and its relations to Hemitrypa, Polypora, Retepora, Cryptopora, etc." This article is continued in the Rep. State Geologist for 1884, p. 35. Sixty-one photo-lithographed plates accompany the Rep. State Geologist for 1882. They are published in advance, with their explanations, under the following heads: "Fossil corals and Bryozoans of the Lower Helderberg group, and fossil Bryozoans of the Upper Helderberg group," p. 17, plates I–XXXIII, in advance of Vol. VI, Palæontology of New York; "Brachiopoda, plates and explanations," pls. XXXIV–LXI, in advance of Vol. IV, Part II, Palæontology of New York. In the Rep. State Geologist for 1883, p. 5, he gives a "Description of the Bryozoans of the Hamilton group (Fenestellidæ excepted)." The 35th Rep. New York State Mus. Nat. Hist. contains the following papers: "Notice of the machinery and methods of cutting specimens of rocks and fossils at the New York State Mus. Nat. Hist," p. 121; "Preliminary notice of the lamellibranchiate shells of the Upper Helderberg, Hamilton and Chemung groups, preparatory for the Palæontology of New York," Part I, p. 215; "Description of fossil corals from the Niagara and Upper Helderberg groups," p. 407; and "Illustrations of the microscopic structure of Brachiopoda," pl. XXII. The 36th Rep. New York State Mus. Nat. Hist., contains the following papers: "Bryozoa (Fenestellidæ) of the Hamilton group," p. 57; "On the structure of the shell in the genus Orthis," p. 73; "Description of a new species of Stylonurus from the Catskill group," p. 76; and "Description of a new genus from Greenfield, Saratoga county, N. Y.," pl. VI. The Rep. State Geologist for 1884 contains the following papers: "On the mode of growth and relations of the Fenestellidæ," p. 35, continued from p. 14 of the Rep. State Geologist for 1882; "On the relations of the genera Stictopora, Ptilodictya, Acrogenia and allied forms in the Palæozoic rocks of New York," p. 46; and "Note (on some Paleozoic pectenoid shells)," p. 47.

Angelo Heilprin has published a book entitled, "Town Geology: the lesson of the Philadelphia rocks. Studies of nature along the highways and among the byways of a metropolitan town;" plates IV and V contain figures of the Cretaceous invertebrate fauna. In *Science*, Vol. V, p. 475, and Vol. VI, p. 83, he has two notes on "The classification and palæontology of the U. S. Tertiary deposits;" these are criticisms of Dr. Otto Meyer's views.

E. W. Hilgard has two papers, one in *Science*, Vol. VI, p. 44, entitled, "The classification and palæontology of the U. S. Tertiary deposits;" and the other in the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 266, entitled, "The old Tertiary of the Southwest;" both are criticisms of Dr. Otto Meyer's views.

G. J. Hinde has a "Description of a new species of Crinoids with articulating spines," in the *Annals and Magazine of Natural History*, 5th ser., Vol. XV, p. 157.

Alpheus Hyatt, in the Proc. A. A. A. S., Vol. XXXIII, Part II, pp. 490 and 492, publishes two notes, one on the "Structure of the siphon in the Endoceratidæ," and the other on the "Structure and affinities of Beatricea." He has a letter (relative to the Pteropods of the St. John group) in the Bull. Nat. Hist. Soc. New Brunswick, No. IV, p. 102. In the Proc. Boston Soc. Nat. Hist., Vol. XXIII, p. 45, he has published an elaborate discussion of the "Larval theory of the origin of cellular tissues."

J. F. James, in the Jour. Cincinnati Soc. Nat. Hist., Vol. VII, p. 151, has an article on the "Fucoids of the Cincinnati group." In the AMERICAN NATURALIST, Vol. XIX, p. 165, he has a note entitled, "Are there any fossil Algæ?" He has also, "Remarks on a supposed fossil fungus from the coal measures;" "Remarks on some markings of the rocks on the Cincinnati group, described under the names of Ormathicuus and Walcottia;" and "Remarks on the genera Lepidolites, Anomaloides, Ischadites and Receptaculites, from the Cincinnati group," in the Jour. Cincinnati Soc. Nat. Hist., Vol. VIII, pp. 157, 160 and 163.

A. A. Julien has "A study of *Eozoön canadense;* filed observations," in the Proc. A. A. A. S., Vol. XXXIII, Part II, p. 415.

G. F. Kunz has an article "On the agatized woods, and the Malachite, Azurite, etc., from Arizona," in the Trans. N. Y. Acad. Sci., Vol. V, p. 9.

Leo Lesquereux's "Contributions to the fossil flora of the Western Territories. Part III. The Cretaceous and Tertiary floras. Rep. U. S. Geol. Surv. Terr., F. V. Hayden, U. S. geologist in charge. 4to, Vol. VIII." Was not published till February, 1885, although it bears the imprint 1883.

A. H. Mackay publishes an article on the "Organic siliceous remains in the lake deposits of Nova Scotia," in the *Canadian Rec. Sci.*, Vol. I, p. 236.

Jules Marcou writes on "The Taconic system and its position in stratigraphic geology," in the Proc. Amer. Acad. of Arts and Sciences, new series, Vol. XII, p. 174.

J. B, Marcou records "Progress of North American invertebrate palæontology for 1884," in the AMERICAN NATURALIST, Vol. XIX, p. 353. This is a brief sketch of the palæontologic work done in the year; a more extended review of it is published in the Smithsonian report for 1884, No. 610, pp. 1–20, Washington, 1885. In the Proc. U. S. National Museum, Vol. VIII, p. 290, he has "A list of the Mesozoic and Cenozoic types in the collections of the U. S. Nat. Museum;" and the "Identification of certain fossils and strata of the Great Sioux Reservation" (in "The Lignites of the Great Sioux Reservation, a report on the region between the Grand and Moreau rivers, Dakota," by Bailey Willis, Bull. U. S. Geol. Sur., No. 21, p. 11).

G. F. Matthew has "Recent discoveries in the St. John group," and "A new genus of Cambrian Pteropods," in the *Canadian Rec. Sci.*, Vol. I, pp. 136 and 152. In the Bull. Nat. Hist. Soc. New Brunswick, No. IV, p. 97, he has "An outline of recent discoveries in the St. John group. With a letter of Professor Alpheus Hyatt relative to the Pteropods." In the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 72, he has a note "On the probable occurrence of the great Welsh Paradoxides, *P. davidis*, in America." In the same volume, p. 293, he has a "Notice of a new genus of Pteropods from the St. John group (Cambrian)." In this he describes the genus Diplotheca. He has a "Note on the genus Stenotheca" in the *Geol. Mag.*, new series, Decade III, Vol. II, p. 425. In the Trans. Roy. Soc. Canada, Vol. II, Sec. IV, p. 99, appear his "Illustrations of the fauna of the St. John group continued; and a paper on the Conocoryphea, with further remarks on Paradoxides."

Charles Morris, in the Proc. Acad. Nat. Sci. Philada. for 1885, pp. 97 and 385, has two articles entitled, "The primary conditions of fossilization," and "Attack and defense as agents in animal evolution."

Otto Meyer, in the *Amer. Jour. Sci.*, 3d ser., Vol. XXIX, p. 457, and Vol. XXX, pp. 60 and 421, has an article in three parts, entitled "The genealogy and the age of the species in the southern old Tertiary." The author assumes the extraordinary position that the succession is just the contrary from what it has hitherto been considered to be, the Vicksburg, according to him, being the oldest and the Claiborne the most recent formation. In "Part I. The geological relations of the species," he partially describes a number of species and varieties, without any illustrations; these he considers to be new. Part II is on "The age of the Vicksburg and the Jackson beds." Part III, "Reply to criticisms." The author defends his views against the criticisms of E. W. Hilgard, E. A. Smith and T. H. Aldrich, in the October number of the *Amer. Jour. Sci.* In *Science*, Vol. V, p. 516, and Vol. VI, p. 143, he has two notes on Angelo Heilprin's criticism of his work.

J. S. Newberry, in the Ann. N. Y. Acad. Sci., Vol. III, p. 217, has a "Description of some peculiar screw-like fossils from the Chemung rocks." They are also described in the Trans. N. Y. Acad. Sci., Vol. III, p. 33.

H. A. Nicholson and Robert Etheridge, Jr., in the *Geol. Mag.*, new series, Decade III, Vol. II, p. 529, have an article "On the synonymy, structure and geological distribution of *Solenoptera compacta* Billings sp."

H. A. Nicholson and A. H. Foord, in the *Ann. and Mag. Nat. Hist.*, 5th ser., Vol. XVI, p. 496, have an article "On the genus Fistulipora McCoy, with descriptions of several species."

A. S. Packard, in the AMERICAN NATURALIST, Vol. XIX, pp. 291, 700, 790 and 880, has the following articles: "Types of Carboniferous Xiphosura new to North America;" "The Syncarida, a group of Carboniferous Crustacea;" "On the Gampsonychidæ, an undescribed family of fossil schizopod Crustacea;" "On the Anthracaridæ, a family of macrurous decapod Carboniferous Crustacea, allied to the Eryonidæ."

B. N. Peach, in *Nature*, Vol. XXXI, p. 295, has "Ancient air-breathers;" a general review of Paleozoic scorpions.

J. H. Perry, in the *Amer. Jour. Sci.*, 3d ser., Vol. XXIX, p. 157, has a "Note on a fossil coal plant found at the graphite deposit in mica-schist at Worcester, Mass."

Julius Pohlman and R. P. Whitfield, in *Science*, Vol. VI, p. 183, have a note on "An American Silurian scorpion."

A reprint of geological reports and other papers on the geology of the Virginias, by the late William Barton Rogers, has been issued.

S. H. Scudder publishes "The geological history of Myriopods and Arachnids. Eighth annual address of the retiring president of the Cambridge Entomological Club," in *Psyche*, Vol. IV, January–March, 1885, p. 245. In the Mem. Nat. Acad. Sci., Vol. III, p. 1, he has a "Description of an articulate of doubtful relationship from the Tertiary beds of Florissant, Colorado." In the Proc. Acad. Nat. Sci. Philada. for 1885, pp. 34 and 105, he has "New genera and species of fossil cockroaches from the older American rocks;" and "Notes on Mesozoic cockroaches." In the AMERICAN NATURALIST, Vol. XIX, p. 876, is an abstract of his paper on the "Relations of the Paleozoic insects."

H. M. Seeley, in the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 355, describes "A new genus of chazy sponges, Strephochetus."

E. A. Smith, in the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 270, has "Remarks on a paper of Dr. Otto Meyer on 'Species in the southern old Tertiary.'"

C. Wachsmuth and W. H. Barris have "Descriptions of new Crinoids and Blastoids from the Hamilton group of Iowa and Michigan."

C. Wachsmuth and Frank Springer issue a "Revision of the Palæocrinoidea. Part III. Discussion of the classification and relations of the brachiate Crinoids, and conclusion of the generic descriptions," in the Proc. Acad. Nat. Sci. Philada. for 1885, p. 225.

C. D. Walcott has a "Description of the (Deer creek, Arizona) coalfield," Senate Ex. Doc. No. 20, 48th Congress, second session, Appendix I, p. 5. He contributes the following papers to the *Amer. Jour. Sci.*, 3d ser., Vol. XIX, pp. 114 and 328, and in Vol. XXX, p. 17, "Palæontologic notes;" "Paleozoic notes, new genus of Cambrian Trilobites, Mesonacis;" and "Note on some Paleozoic Pteropods."

L. F. Ward, in the *Botanical Gazette*, Vol. IX, p. 169, has "The fossil flora of the globe." In the Proc. A. A. A. S., Vol. XXXIII, Part II, pp. 493, 495 and 496, he has "Historical view of the fossil flora of the globe;" "Geological view of the fossil flora of the globe;" and "Botanical view of the fossil flora of the globe." In the AMERICAN NATURALIST, Vol. XIX, pp. 637 and 745, he has an article on "Evolution in the vegetable kingdom."

C. A. White has "The application of biology to geological history, a presidential address delivered at the fifth anniversary meeting of the Biological Society of Washington, January 24, 1885," in the Proc. Biol. Soc. Washington, Vol. III, p. 1. In the *Amer. Jour. Sci.*, 3d ser., Vol. XXIX, pp. 228 and 277, he has "Notes on the Jurassic strata of North America;" and "The genus Pyrgulifera Meek, and its associates and congeners." Bull. U. S. Geol. Surv., No. 15, is "On the Mesozoic and Cenozoic palæontology of California." Bull. U. S. Geol. Surv., No. 18, is "On marine Eocene, fresh-water Eocene and other fossil Mollusca of Western North America;" it is divided into three parts: I. The occurrence of *Cardita planicosta* Lamarck, in Western Oregon; II. Fossil Mollusca from the John Day group in Eastern Oregon; III. Supplementary notes on the non-marine fossil Mollusca of North America. Some additions and corrections for the illustrations on p. 19 are made to the above work. Bull. U. S. Geol. Surv., No. 22, is "On new Cretaceous fossils from California."

J. F. Whiteaves has a "Report on the Invertebrata of the Laramie and Cretaceous rocks of the vicinity of the Bow and Belly rivers and adjacent localities in the Northwest Territory" in the Geol. and Nat. Hist. Surv. Canada, A. R. C. Selwyn, director; Contribution to Canadian palæontology, Vol. I, Part I. In the *Amer. Jour. Sci.*, 3d ser., Vol. XXIX, p. 444, he has "Notes on the possible age of some of the Mesozoic rocks of the Queen Charlotte islands and British Columbia." In the Trans. Roy. Soc. Canada, Vol. II, pp. 237 and 239, he has "Description of a new species of Ammonite from the Cretaceous rocks of Fort St. John, on the Peace river," and "Note on a decapod Crustacean from the Upper Cretaceous of Highwood river, Alberta, N. W. T."

R. P. Whitfield contributes to *Science*, Vol. VI, p. 87, "An American Silurian scorpion." In the Bull. Amer. Mus. Nat. Hist., October 10, 1885, Vol. I, No. 6, pp. 181, 191 and 193, he has the following articles: "On a fossil scorpion from the Silurian rocks of America;" "Notice of a new Cephalopod from the Niagara rocks of Indiana;" "Notice of a very large species of Homalonotus from the Oriskany sandstone formation."

H. S. Williams, in the Proc. A. A. A. S., Vol. XXXIII, Part II, p. 422, publishes an article on "Geographical and physical conditions as modifying fossil faunas." In the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, p. 45, he has a "Notice of a new limuloid Crustacean from the Devonian."

A. Winchell, in the *Amer. Jour. Sci.*, 3d ser., Vol. XXX, pp. 316 and 317, has "Notices of N. H. Winchell on Lingula and Paradoxides from the red quartzites of Minnesota," and "On Cœnostroma and Idiostroma and the comprehensive character of Stromatoporoids."

N. H. Winchell describes "Fossils from the red quartzites at Pipestone" in the Geol. and Nat. Hist. Surv. Minnesota, 13th Ann. Rep., p. 65.

H. H. Winwood, in the *Geol. Mag.*, new series, Decade III, Vol. II, p. 240, remarks on the "Geological age of the Rocky mountains;" in it he reports finding a Menevian fauna between the 116th and 117th parallels of longitude on the Canadian Pacific railway.

B. H. Wright, in the 35th Rep. N. Y. State Mus. Nat. Hist., p. 195, contributes "Notes on the geology of Yates county, N. Y."

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GRAVITATION AND THE SOARING BIRDS.

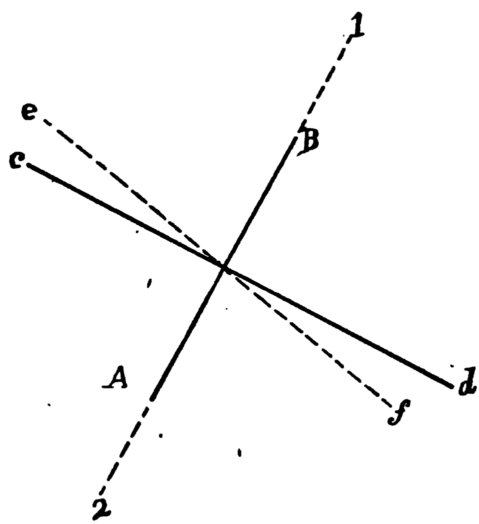
BY I. LANCASTER.

"IN experimental philosophy, all propositions collected by induction from phenomena are to be held either exactly or approximately true until other phenomena are found by which those propositions can be made either more accurate or subject to exceptions" (Newton's Principia, Book III).

The soaring birds seem to be excused from obedience to the laws determining the actions of other inert bodies heavier than the air, which are abandoned to its support. Weighing more than the air they displace, and using no muscular exertion to sustain themselves, they still, in the sense of getting nearer to the earth, do not fall. When we seek for a motive power which is competent to resist the weight of the bird's body, and neutralize the resistance of the air to its translation, we seem baffled. Bird and air form a material system in which no other object is included, so that it is impossible to obtain power from the wind. Wind is motion of the entire system as a whole, compared to a fixed object, as an observer, and such motion does not affect the motion of the parts. Wind from any direction, or at any velocity, or entire calm are differences of air-conditions to an observer, but not to a bird. We are therefore limited to the gravitating force of the bird's body to find the power producing the phenomena, as it is nowhere else discoverable. But here we are confined to certain notions derived from sticks and stones, and in fact all other falling things, and they do not seem to help us in explaining a thing which does not fall. We are likewise taught that the direction of the gravitating force is vertically downwards, *i. e.*, in a straight line from the body manifesting it to the center of the earth. What we understand by this "direction" is, that when gravity does work, when it is in the act of making anything different from what it was before, when it moves a thing at rest, or stops it when in motion, or accelerates it, or is in the act of manifesting energy in the way which we call "work," that the "direction" in which it does it is vertically downwards. How then can this force drive a body upwards, or translate it horizontally?

Still further. Although we admit, when our attention is called to it, that weight is the result of gravity acting on a quantity of matter, we are apt to confound mass, and weight, and gravity into one identical thing. This is inadmissible, since the doctrine of the correlation of forces is established, as it is entirely possible to change every atom of gravitating force which a body manifests into some other form of force, in which case either the former is separate from the quantity of matter or the latter is created. We thus find ourselves in a sort of dilemma. We are obliged to consider gravity as something apart from body, and still we have no knowledge of it excepting what we are enabled to infer about it. Were it not for these inferences we would be shut up to the conclusion that the quantity of matter was acting, and that gravity, as a separate force, was simply non-existent, for it never manifests its power but in connection with body, and the action of the body is our rule to determine the action of the force.

It would be expected that in dealing with agencies of this kind, the greatest care should be exercised lest we fall into errors, and it is apparent that many of our notions in regard to gravitating bodies have been brought up from generalizations which do not include all the facts. The soaring birds have been omitted. To the extent of their exclusion our ideas are subject to error. It is imperative that they be brought under the dominion of gravity, and that the phenomena presented by them shall have due recognition in determining the characteristics of that force.



I have shown in the pages of this magazine that these birds can be reduced to lower terms. A plane resting in air, and acted on by a force, exhibits all their activities, and up to this time, so far as my knowledge extends, the mechanical world has failed to recognize the facts exhibited by such a body, when subjected to work on elastic air.

To accomplish my purpose most directly, it will be best to touch upon ground already covered, and I will do so in the following propositions, which are self-evident on statement. Unless otherwise noted, acceleration will be supposed to have terminated and uniform motion progressing.

As there is no authority for the value of frictional resistance of air on smooth surfaces, and as I have failed to measure it by any experimental test at my command, on account of its extreme smallness, the argument would be in no wise affected if it were not taken into account for any of the velocities that we shall deal with. The reader may therefore place upon it any value within reasonable limits.

Let *A B* represent one of the edges of a plane, say one foot square, resting in air, and of the same weight as the atmosphere it displaces.

1. The only actual or conceivable work the plane can be subject to under the dominion of any force whatever, is either air pressure upon its sides, or resistance to atmospheric surface or skin friction, parallel to itself or in its own plane.

2. From the law of fluid pressures, and the contrary and equal character of action and reaction, a force operative upon the plane *A B* from any direction, does work in one, or both, of two ways, viz., either in it or at right angles to it.

3. Forces in the direction of *c d*, or in the plane in any direction, are not resolved by the plane, but work to their full value in absolute independence of each other, as they are right-angled forces.

4. Forces from any direction, excepting in the plane and normal to it, are resolved by the plane into those two directions.

5. Any number of forces, not in the plane nor normal to it, operate upon it in the resultant of one force, from one direction; and this resultant, if not already in the plane or normal to it, is resolved therein by the plane.

6. It follows that the plane can be subject to work only, (1) in its own plane, (2) in a direction at right angles to its surfaces, (3) in both of these directions.

7. The nature of the work done by the force acting normal to the plane is compressing air, and as the resistance of the atmosphere to motion in this direction is very great, the velocity will be correspondingly slow.

8. The nature of the work done by the force in the plane, is overcoming atmospheric friction on the two surfaces, which being very little, motion in this direction will be correspondingly great.

9. A force not in the plane, nor normal to it, is resolved by the

plane into those forces in the same ratio that the direction of the force bears to those directions.

To illustrate these propositions we will suppose a force, *e f*, inclined 18° from *c d*, to operate on the plane *A B*, with a value of sixty foot pounds per second. The plane would instantly resolve this force into twelve foot pounds in its own plane in the direction 2, and forty-eight foot pounds in the direction *c d*, at right angles to it, when it would be reasonable to suppose that the twelve pounds would drive the plane against friction of air with far greater velocity than forty-eight pounds would against air compression.

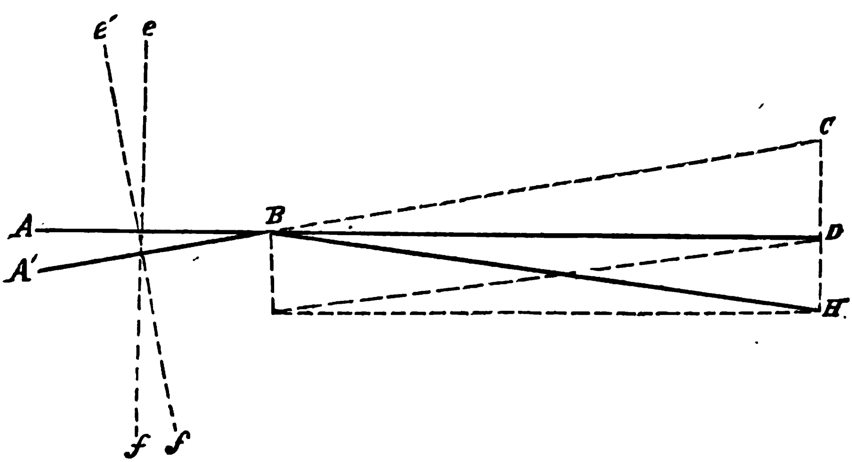
If motion in the direction 2 were resisted to the point of prevention, all the force, *e f*, would do work in the direction *c d*, when the entire sixty pounds would be setting up air pressure, and the plane would be in equilibrium in the direction 1 2. A very small force, say one or two pounds, would now drive the plane in any direction, say towards 1, with considerable velocity.

It is obvious that the sixty pounds of air pressure would be enough to supply the twelve pounds needed to balance the force acting towards 2, and the one or two pounds additional needed to drive the plane towards 1 with a velocity we will suppose of 150 feet per second. If we suppose the motion of the plane in the direction *e f* to be at the rate of thirty feet per second, it will move in opposition to the direction of the force as fast as it does with its direction, and we will have the anomalous case of a force developing enough force in moving a body to move several such bodies through the same space in the same time diametrically opposite to its own direction!

This seems absurd, and needs rectification to make it tolerable. We have entirely overlooked the fact that the moment *e f* began the task of working it abandoned the direction in which it resided, and four-fifths of it went over 18° to *c d*, and one-fifth went over 108° to *A B*. The direction *e f* is vacated, it is without significance. For all the influence it has on the plane it might as well not exist. There is *now* no movement of the plane against the direction of the force whatever. *Now*, the forces working on air, and driving the plane towards 1, are at right angles to each other and do not resist each other. The problem is, the ability of a force to drive a plane faster edgeways than flatways through air.

In going over, the one-fifth that traveled 108° was wasted, *i. e.*, it neutralizes an equal amount of the other, so that only forty-eight pounds, instead of sixty pounds, are available to drive the plane edgeways; but this would be competent to produce an enormous velocity. Had the force been originally in *c d*, the entire sixty pounds would have been available.

But when we rectify the diagram so as to make *e f* vertical, and add two pounds weight to the plane, so that the force employed will be gravity, all the ghosts, which we supposed laid, at once reappear in vastly magnified proportions. The outcry now is, that the law of falling bodies is violated, for a body in falling can do no more work than sufficient to lift it through the same



perpendicular height. It seems that here is a good place to establish an exception, and we will examine into the way in which it may be done.

While the plane *A B* is level, the gravitating force is not resolved by it, but acts at right angles to the surfaces, when lateral motion will be resisted by nothing but atmospheric friction, and this the one or two pounds is competent to overcome, driving the plane to *D* while it is falling the thirty feet in which the sixty pounds is developed. It will therefore pass to *H*, the resultant of the two motions. It will simply have a lateral motion of 150 feet edgeways through the air added to its fall of thirty feet. To its work of air compression there will be joined an additional item of work in overcoming 150 feet of atmospheric friction. The force developed in the fall will be enough to supply the lateral force and still leave fifty-eight or fifty-nine pounds to go to waste by falling to the tension of the surrounding air.

But this would not be "soaring," as the plane will soon reach the ground.

If we now throw the plane over on an incline of one in five, or 18°, we have an additional twelve pounds of lateral resistance to overcome, which the sixty pounds is entirely competent to effect, together with the one or two needed to carry the plane to *c*, and still have forty-six or forty-seven pounds more than is wanted left over. We now have the plane elevated as fast as it falls, so that its resultant passage to *D* is the horizontal translation of flight, and a body in falling does work enough to not only lift it to the same height from which it fell, but to move it against air resistance, and have a large surplus left over!

This seems impossible. But the reason of such appearance, as already shown, is that we are entertaining a fallacy. We are supposing the direction of the gravitating force to still be vertical after it has gone over eighteen and a hundred and eight degrees. We have, as a matter of fact, changed the direction of gravity more than we have slanted the plane. One-fifth of its total amount has gone over 108°. The plane has taken the same liberty with the great cosmical force of gravitation that it would with any other force. It refuses to be operated upon by any energy whatever of a mechanical kind while doing work on elastic fluids, excepting in the two directions mentioned, and any force whatever, not in either of these, is instantly put there by the plane. To say that the gravitating force is still vertical, and has not gone over, is to increase the difficulties of the case and not to abate them. In such event the law of fluid pressures is violated, which demands that they be at right angles to the compressing surface. The plane would also fall vertically without lateral motion, all of which is impossible. *Some* force is actuating *A′ B* in its own plane and normal to it. From whence comes it? There is but one source of supply. The plane has simply resolved gravity until its perpendicular line has been vacated, and re-located at right angles to the lateral force acting in the plane, which lifts no weight, and resists nothing whatever but friction. The plane, in its translation towards *c*, is moving towards *e*, but not towards *e′*. It is going contrary to the abstract direction of gravity, but not contrary to the direction in which that force is now working, which alone concerns us.

The whole matter hinges on the ability of a plane to resolve the gravitating force as it resolves other forces. In doing so it does a very wonderful thing. It makes of gravity a continuous motive power. It introduces a new idea into our conceptions of things, and makes it imperative that we rectify our notions of the gravitating force so as to admit these facts, which we have not hitherto recognized.

It dignifies the soaring birds into the position of favored creatures of nature. They inhabit a universe of their own. The horizon of their world is not the level of the sea, but the incline of their own wings, which they can change at will. Their gravitating force is either in a straight line from their bodies towards the center of the earth, or the moon, or the sun, or any of the stars of heaven, indifferently, as it suits them, to sleep on the breeze, to play at gymnastics high in air, to enact the rôle of the highway robber, or to serenely float from zone to zone.

I have now presented the case of the soaring birds to the extent of my ability. The task could have been better done by a specialist in analytic mechanics, as it is in this sphere that its significance lies. The whole matter is extremely peculiar. In consequence of the throng of preconceived ideas which tend to cast the obscurity of night over the whole case, the evidence upon which it rests, although axiomatic throughout, is difficult to see. The mechanism also seems devoid of organization, a simple plane is all there is of it, and still it has the power to change the horizon of the world to suit its own purposes. It would be unwise to suppose that a device capable of doing this was not competent to give to man what he has long coveted, the power to navigate the air.

Certainly we must entertain two standards of horizontal, one the level of the sea, and the other the incline of the wings of the soaring birds.

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CAUSES OF FOREST ROTATION.

BY JOHN T. CAMPBELL.

IN a letter recently received from Dr. S. V. Clevenger, he mentioned a case coming under his own observation on the North Pacific railroad, in Minnesota, near Mille Lacs, where the railroad company cut the pine timber off of their own alternate sections for railroad ties and other purposes. This pine forest was succeeded at once, to all appearances spontaneously, by oaks.

I have often heard North Carolinians say the same thing about old fields in that State, when abandoned as worn-out land, that some timber different from that which had been cut off when clearing the land at first, would spring up spontaneously, or appear to be spontaneous.

I can speak only for my own locality, not having observed any other. Here (West central Indiana) we have in many localities a prevailing species of timber, but no species that exist to the exclusion of all others, as is often the case with pine. But of our prevailing timber, or any other kind, sugar maple excepted, none seem to be reproducing their kind in their immediate vicinity. For reasons which will follow, I surmise that nearly all forest trees bear and shed leaves which are unfavorable to the sprouting and growing of their own seeds. The most notable instance I can now think of is the red cedar, introduced into this vicinity from the north and north-east about forty-five years ago for ornamental purposes. I don't remember at what age they began bearing seed, but I think as early as ten years, counting them to have been three years old from the seed when transplanted here. Until certain kinds of birds began to eat their seeds, they were not found growing wild in the forests. I do not know what birds eat the seed, but evidently all do not, else they would have been planted as soon as the parent trees bore seeds, which was not the case for fully fifteen years afterward. When these seeds pass through the craw and intestines of birds they are prepared to sprout when they come in contact with the ground of the proper degree of moisture. Nurserymen, when they gather them direct from the trees, are obliged to put them through some process of scalding before planting. The birds drop them promiscuously over the country, where they have been appearing within the past fifteen years numerously, and only rarely before about that time. They are a hardy tree, and bid fair to become one of the forest trees of the future in this part of Indiana. It is reasonable to presume that these seeds would be more abundantly dropped under and very near these parent trees than elsewhere, for quite probably the birds that nest in these trees eat their seeds. Yet no young cedars are ever seen to sprout and grow there.

The same is true (*i. e.*, not growing their young within the radius of their leaf-fall) of the white pine, firs and other evergreens transported here for ornamental purposes. Some of the older ones are twenty inches in diameter, and have borne seeds many years.

I have long observed that the seeds of forest trees shed upon the forest leaves, sugar maple excepted, cannot sprout. This is very specially the case with the American poplar seeds. Yet I often find in the woods clusters of young poplars, varying in age from one year to sixty and seventy years. Last year I found out how this comes about. If the seeds happen to fall on the bare ground of the right degree of moisture, they at once take root and grow. If about the time these seeds are falling there should be a hog in the woods and he should have an appetite for ground worms, he would thrust his strong snout through the leaves into the ground and cast up fresh earth in a very promiscuous manner, and every poplar (or other) seed that should happen to fall on that fresh ground would stand a good chance of growing. I saw young poplars just barely sprouted under the above circumstances, while at the same time other and brother seeds had fallen on the leaves near by, where they lay dead and as dry and crisp as smoking tobacco.

Sometimes squirrels, hares, ground squirrels (chipmunks) dig through the leaves into the ground for food which they find there, I presume, and these places give a chance for one or more seeds to grow, and the hoofs of heavy bullocks (and in times past the elk and buffalo) have made deep tracks through the leaves into the ground, which would give a like chance, whilst the coating of leaves would prevent the growth of all the rest. The hogs were brought here at the very earliest time of settlement, turned loose in the woods, where they multiplied rapidly, becoming wild, ferocious and more dangerous to man than bears, wolves or panthers. Many of these clusters of poplars correspond in age to this time.

In Rockville, Indiana, where I reside, the river-bottom soft maple is very generally planted for a street shade-tree, mainly because of its rapid growth. Many of these are ten to twenty inches in diameter at the butt, and have been bearing seeds for years. The seeds of this tree must find favorable growing conditions as soon as they fall or they are lost, for one day's baking in the hot sun kills them. They must have a steady moisture with warm but not hot sunshine. The trees bore a bountiful crop of seed last May, and of the first that matured and fell, I tried to sprout about a dozen by placing them in good ground and watering every day for several days. But as I could not give them all my time, they dried up between waterings and died. After these had died, there came a threatening, blustering storm one Sunday evening about sundown, which shook off the remaining soft maple seeds. They were so abundant that they gave the streets a buff color where they fell. The wind was followed by a light, steady rain, which continued several days, alternating with sunshine. This was favorable to sprouting these seeds, and they came up all over the streets, yards, and gardens as thick as weeds in a neglected field, a thing that never happened before in the twenty-two years I have resided in the place. Those in the street the cows ate up; those in the gardens were weeded out, and those growing elsewhere were killed by the following summer drought. On the south end of my garden, where a cellar drain terminates, the proper moisture was maintained through the drought, and there stands a thick cluster of them, the only survivors, so far as I know, of the millions that sprang up last May. After these trees are three years old they can be successfully transplanted into any kind of soil we have here, and seem as hardy as any dry-ground tree; but during their infancy the conditions *must* be as before stated or they die. So I think it is clear that this tree will never be self-planting, except along the low, moist bottom of the streams where we find it native.

The hard sugar maple does plant its own seeds within the radius of its own leaf-fall. In 1884 there developed a local rain in the south-east quarter of this (Parke) county which continued showery for several days, alternating with sunshine, just as the sugar maple seeds were falling. The result was as in the case of the soft maples last May; all the seeds sprouted. As this favorable condition did not happen when the other trees were shedding their seeds, the result in that part of the county is, that the sugar maples are a hundred to one of all the other young trees combined, and the deep snow and cold winter that followed, making a hard crust on the snow, prevented the sheep, cattle and rabbits (hares) from browsing them down, though it starved thousands of rabbits, as their bones found in hollow logs and trees abundantly attest; but it saved the young sugar maples till they are now large enough to be safe from every enemy except man. If he were out of the way for 150 years about all the present forest trees will have lived out their time, and these young sugar maples would be almost the only trees of the forest in the area where a rain happened to fall with the seed. In the other three-quarters of the county that state of things would not exist, for there only the lucky seed that fell where a hog had rooted or a bull had trodden has made a tree, and this luck was as favorable to other seeds as to the sugar maple. These maple seeds send rootlets right down through the coating of leaves into the ground, and I have seen, over an area of many acres at a time, a maple sprout for every four inches square, or nine to the square foot, none seeming to have missed sprouting. In replanting the ground where the present forest has been cut away, the sugar maple makes the least show of all the forest trees. As an infant it seems to thrive best in the shade of older trees.

How the oak can take the place of pine where there are no oaks in the vicinity to bear acorns, I am not sure, but it is easier and more rational to believe that there is some natural agency for transporting the seed of the apparently spontaneous new tree, than to believe it to be really spontaneous, whether we understand the transporting agency or not.

One of the most industrious and persistent seed-transporting agencies I know of is that ubiquitous, energetic, rollicking, meddlesome busybody, the crow. Did you ever take a young crow and raise it as a pet? Please do so once and you will have more information about crows than I could give you in an entire number of the NATURALIST. They become very tame, and after they are able to fly it seems to be the delight and work of their lives to pick up and carry from place to place any and every article which is not too heavy for them. After a pet crow has had a little practice he is as expert at tricks of legerdemain as a showman. He will steal a spool of thread, a thimble, a pair of scissors, a paper of pins, or what not? right before your eyes, and as he flies away will tuck it so adroitly up under his tail feathers that you can't see it. He makes a deceptive grab as he starts to fly, by taking a few steps as if to give himself a little momentum to start his flight, and one of these steps he will plant square on the article he intends to steal, when his claws close round it and off he goes. Perchance he will alight only a few yards distant on the ground beside a chip, which chip, as he alights, he will so quickly and adroitly turn over with the other foot as to cover out of sight the article he has taken. He will then take a few steps about the chip with his toes all properly radiating, purposely to show you that he does not hold the missing article in his claw. Unless you are acquainted with his tricks you would concede that he had not taken your thimble, so adroitly is the trick performed. Then he is ready for some new mischief. Off he goes to the chicken-yard where a hen and her chicks are scratching for bugs. He alights plump into their midst. The little chicks scream and scamper for shelter. The old hen, with her feathers all awry, dashes at him as if she would tear him into strings, but just as she gets in striking distance the crow opens his mouth and caws loudly right into her face. She stops abruptly, hesitates and slowly backs off. Then comes the cock of the yard, like a charge of cavalry, to drive the intruder from his premises; but as he too gets in striking distance, the crow opens his mouth about three inches wide and caws so loud, right into the cock's face, that he can be heard a quarter of a mile. The cock too stops suddenly, and his look of surprise and amazement is most amusing. His wrothy feathers gradually smooth down and he takes a few steps cautiously backward, then whirls and runs back under the rose-bush and there tells the hens how the crow acted, like Irving's Knickerbocker soldiers who were sent up the Hudson to capture a fort, and who had nose, thumb and fingers all wiggled at them at once over the wall by the garrison, which was such a strange and unexpected proceeding that they hastened back to headquarters to report what had taken place.

I had a pet crow two years ago that cut so many tricks in his way that a neighbor shot him one morning. Afterward, in cleaning the leaves out of my eave troughs, various of our own and our neighbors' articles were found in the troughs and on the roof,

The crow in his wild state is all the time busy at some such work as I have described. I cannot discover that he has any design in this busy, meddlesome mischief. If there is design in his work it is back of the crow in the Great Superintendent of nature's processes. I have seen crows gather by hundreds and have a regular pow-wow, a mass convention where they seemed to discuss measures and appoint officers. I have heard their cawing more than a mile distant. At length they get through, by finishing their work or tiring of it, and disperse. As they start to fly away many, if not all, will drop something. I have found these to be acorns, walnuts, hickory-nuts, buckeyes, sycamore-balls, sticks, egg-shells, pebbles, &c. As a crow leaves an oak he will pluck an acorn which he may carry five miles and light on a beech tree, where something else will attract his attention, when he will drop the acorn and may be pluck a pod of beech nuts and fly away somewhere else.

The squirrel is also a nut-transporting agent. The hog will eat his nut where he finds it, but the squirrel must find some suitable place to eat his nut, like some fastidious boarders I have known, who would not and could not eat if they failed to get their own conspicuous place at table. The squirrel will select his nut, take it in his mouth, skip along a few yards, pause a moment, then a few more skips and pause, preferring a fence or fallen tree to the ground for his roadway. He will sometimes carry his nut several hundred yards, not to his home, but to some conspicuous tall fence-stake or dead projecting limb of a tree, on which he sits on his haunches, his tail curled over his back, and in this striking attitude he complacently gnaws through the shell of his nut to get the kernel. It will sometimes happen that just as he is ready to begin on his nut a hawk will swoop down after him, and His Complacency is glad to drop his nut and flirt down to the under side of the limb for protection. This nut may fall on good ground and make a future great forest tree. He will be chased by a dog, fox or hawk sometimes while on his way to his eating place, and involuntarily plant an oak, a walnut or hickory. The partition fences across our cleared farms and stumps out in the fields have many such planting of oak, walnut and hickory, far from the trees that bore the nuts, which I attribute to the crow or the squirrel.

I know a place about four miles south-west of here, where a low place in a field was too wet to be plowed, and has grown up full of young bur oaks, but there is no parent tree anywhere near, not near enough even for high winds to carry such acorns. Such acorns sprout only in wet ground. I think this grove of bur oaks is the result of a frolic of the crows. They had a previous frolic on a bur oak, and in leaving it for this place, each carried an acorn, as is their habit,

OBSERVATIONS ON YOUNG HUMMING-BIRDS.

BY H. S. GREENOUGH.

DURING the month of June last, I heard through friends of the nest of a humming-bird (*Trochilus colubris*) at Cotuit, on Cape Cod, where I was then staying, and having long wished for such an opportunity, I immediately decided to do what I could towards observing the growth of the young. Unfortunately the position of the nest made this rather difficult, for it was on a small dead branch of a yellow pine tree, some distance from the trunk and twelve to fourteen feet from the ground, or thereabout. Of four nests that I have seen, all in Cotuit, three were in yellow pines and one on a silver poplar, two about twenty or twenty-five feet high, one nine or ten and the last as above stated; the one on the poplar was on a small dead branch; with regard to those that were highest up, I do not remember whether they were on dead limbs or not.

The young birds were first seen by me on a Saturday, the previous Wednesday a lad, whom I sent up the tree, reported two eggs, as he had already done once before, so that I cannot say when the birds were hatched, and had feared to make daily visits at this stage lest I should frighten away the old bird. By means of a long step-ladder, improvised for the occasion by tying together two ordinary ladders, I was enabled to view the young within a few inches. Though very small, they were rather larger than I had expected them, and appeared to be already covered for the most part, a bare streak extending, however, down the middle of the back; *the bills were very short and of wide gape and yellow*, and the general appearance of head and bill was decidedly swift-like, but whether the bill was of the full fissirostral type, *i. e.*, gape extending to below the eye, I am not sure. I feared to take the young out for

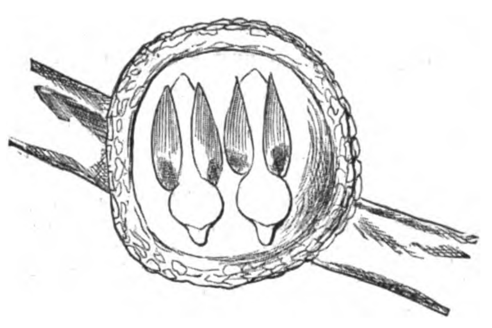

FIG. 1.—Diagrammatic sketch from memory of young when first seen. A trifle reduced; heads too small in proportion to bodies.

closer inspection lest I should injure them or frighten off the old bird, and I particularly wished to ascertain other points which could only be done by leaving the nest undisturbed. The two young lay quite still at the bottom of the nest (which was deeper than those I have seen after the birds have left, and with sides and edge beautifully finished) with their heads pointing the same way and their bills somewhat upward and against the side of the nest. The annexed diagram, from memory, will give a fair idea of their general appearance at this time, it being borne in mind that special attention was paid to the head and bill.

On the following Thursday I again went up to the nest, and found the birds somewhat grown and the typical humming-bird bill beginning to show itself. I can best describe it by saying that it looked somewhat as if it had grown out of or on to the other like an extraneous thing, but was still only a fraction of an inch long, say a quarter or trifle less. During this time the old bird had been on the nest nearly always when I passed by, or if away was very soon back. A few days later, however, I found her absent for some time, at different hours of the day, and feared some accident had happened, but on watching near by I finally saw her return and feed the young and then sit on the nest again. I now borrowed an opera-glass and passed a good deal of time watching the feeding of the young. When first seen the old bird perched on the edge of the nest in an erect attitude, very much as a woodpecker on the trunk of a tree, and bent down her bill close to her nest whilst feeding the young; later on the position was varied, sometimes sitting nearly horizontal and feeding a bird on the opposite side of the nest. After the young got a little larger she could be seen to thrust her bill into theirs; she fed first one and then the other, apparently by regurgitation from the crop, for a motion could be seen in the region of the throat, and after feeding one she would hold up her head for an instant before feeding the other. In a few days she ceased to brood the young, but fed them very frequently. I often saw her fly to the nest, and when she had gotten near she would generally poise and look round before perching on its edge. On going away she would sometimes fly off immediately till out of sight, at others would alight some twenty to forty yards off and stay for

FIG. 2.—Diagram of young humming-bird's head on Thursday, *i. e.*, sixth day it was seen. From memory.

a few minutes, and then away as before. She did not appear to mind my presence much, if at all, though I was quite near, within thirty feet and sometimes much less, say fifteen or seventeen, *i. e.*, almost directly under the nest. At no time did I see the male bird come about the nest. Some ten days or thereabout after the young were first seen, their bills began to show above the edge of the nest, and soon after were generally plainly visible.

On the morning of the fifteenth day after the birds were first seen, one of them was observed to flutter its wings just a little for the first time. I now judged that the birds would soon leave, and accordingly passed several hours every day under the nest.

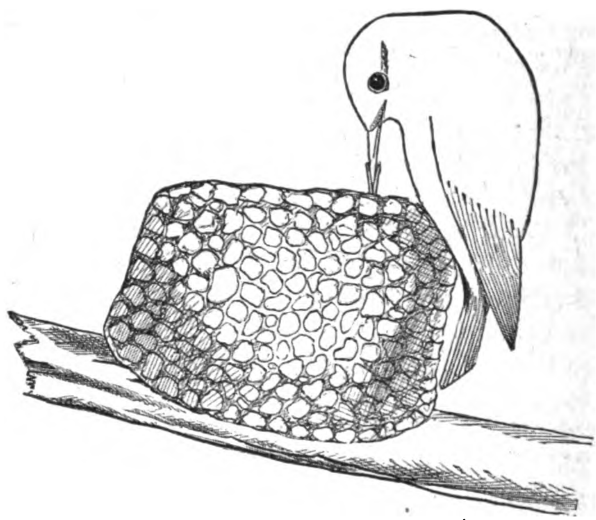

FIG. 3.—Humming-bird feeding its young; copied from pencil drawing made on the spot in summer of 1885.

The restlessness of the young increased; their heads generally showed above the edge of the nest, they looked about and frequently turned round, and every now and then one would flutter its wings, or sometimes only spread one or both; this phase was very interesting to observe on account of the progressive activity shown, and that without leaving the nest at all. By the following Wednesday the restlessness had increased very much, the birds raising themselves somewhat and the motion of the wings being very rapid, producing a gauzy, halo-like appearance as in old birds. The following morning, Thursday, *i. e.*, the twentieth day, I saw one of them raise himself on "tip-toe" and, fluttering his wings, get upon the edge of the nest and then down upon the branch, sit there a moment, and then back into the nest in the same way. I watched all the morning, but neither bird left the nest, though both seemed very restless; on my return in the afternoon only one young bird remained. I saw the old one feed him once or twice, and noticed that she approached him from a different direction to what I had before seen, coming downwards from the clump of pines, on the edge of which stood the nesting tree, instead of the open glades from which I had always before seen her approach. I accordingly laid on my back and looked upward, and presently saw her return and perch on a bough beside another humming-bird, feed it and fly away. I now watched the bird on the bough very carefully and soon saw it fly, and this it did repeatedly at short intervals, sometimes down, again up, on a level and in curves; except for the shortness of its flights, I could see no difference from that of the old bird (and as it was well grown, had I seen it casually I should not have known it for a young one); there appeared to be the same precision of movement, facility of turning and rising, and the same humming style of flight, though I was not near enough to hear any sound. Once toward the end of an unusually long flight, I thought, I perceived signs of fatigue, but do not feel sure of this. The second bird continued in the nest, and was still there on Friday morning and again in the afternoon, the other bird being in the neighboring trees, flying perfectly, and both frequently fed by the old one. On Saturday morning the second bird had also left, and all three birds, if I remember rightly, were observed in and about the neighboring trees. I now tried to get some pots of flowering plants to place near by, and determine, if possible, how soon the young would begin to feed themselves, but did not succeed in obtaining any, so that I could not ascertain this point.

I frequently heard a faint chirping just before or during feeding, but do not know if made by old or young, or both, though, as when feeding the flown bird, I once saw the old one seek him some little time, he having changed his place, and heard the chirping: I am in this case inclined to think the young bird must have made the sound, and perhaps the old one also.

I once saw the old bird thrust her tongue out, and to a much greater distance than I should have supposed.

I was unable to secure any photographs, though a friend kindly tried to take some for me, our ladder proving too short to admit of getting the camera into position for focussing; but the rough drawing made on the spot with the aid of an opera-glass may give a better idea of the feeding position assumed by the mother bird than my description has done.

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THE MECHANICS OF SOARING.

BY PROFESSOR J. E. HENDRICKS.

As Mr. I. Lancaster has published, through the medium of the AMERICAN NATURALIST, his very interesting and valuable observations of soaring birds, and has, in the April number (No. 4, Vol. xx) given an explanation of the mechanics of soaring that might lead non-technical readers astray, a brief review of the "Mechanics of Soaring" may not be unprofitable to some of the readers of the NATURALIST.

As much that Mr. Lancaster has said is in accordance with the recognized principles of mechanics, I will not encumber the pages of the NATURALIST with a general review of the whole article, but will confine this paper mainly to a consideration of the question proposed by him and which he regards as a crucial test of the validity of his theory of soaring.

In investigations concerning the operation of forces, it is important that the distinction between continuous and momentary forces be kept in view. Although all forces require time for their operation, yet such forces as act for a short time and then cease to act, are called *momentary* forces, and the time during which they act is not considered; the velocity induced being constant and equal to the intensity of the force divided by the mass.

When a force acts uniformly for a considerable portion of time, it is called a *constant* force, and the time of its action is involved in the velocity it induces, which is represented by the intensity of the force multiplied by the time and divided by the mass or weight of the body.

Although we do not know what produces the phénomena of gravitation, we know, as manifested on the surface of the earth, it is a result of two opposing forces (a centripetal and a centrifugal force) whose difference at any point on the earth's surface is indicated by the weight of the body at that point. Weight, therefore, or gravity, is a constant force, and differs in no respect from any other constant force.

It is found by experiment that a current of air, having a velocity of thirty feet per second, and meeting a stationary plane, the projection of which, in the direction of the motion, has a superficial area of one square foot, exerts upon the plane, in the direction of the current, a force = 2 lbs. × $\sin^2 \theta$, where θ denotes the angle which the plane makes with the direction of the motion; and for different planes the force is approximately proportional to the areas of the planes, so that on a plane one foot wide and six feet long, as supposed by Mr. Lancaster, when the current is normal to the plane, the force exerted upon the plane by a velocity of thirty feet per second will be twelve pounds. This is the value of the special force assumed by Mr. Lancaster, and whether we consider the twelve pounds pressure as resulting from a constant atmospheric current or any other cause is obviously indifferent.

If then we suppose the weight of the plane to be twelve pounds, and its descent vertical through a quiescent atmosphere, while the plane surface is horizontal, the case will be that of a falling body in a resisting medium, and when the plane shall have acquired a velocity of thirty feet per second, we know, from the experiments above referred to, that the plane will meet a constant resistance of twelve pounds, and this being the weight of the plane it will thenceforth descend with the uniform velocity of thirty feet per second.

If while thus descending, in equilibrium, a momentary horizontal force, the intensity of which is equal to gravity, be impressed upon the plane, because it would impart to one pound a velocity of thirty-two feet per second, it will therefore impart to the plane, the weight of which is twelve pounds, a velocity of only $\frac{1}{12} \times 32$ ft., or $2\frac{2}{3}$ ft. per second, instead of 1000 ft. per second as assumed by Mr. Lancaster.

If now the plane be tilted so as to make an angle θ with the vertical, the vertical pressure it will encounter, when the velocity is thirty feet per second, will be 12 $\sin^3 \theta$ lbs., and because its weight remains the same the plane will cease to be in equilibrium. An increase in the velocity of the descent of the plane in the ratio of $\sqrt{\sin^3 \theta} : 1$ would restore the equilibrium and the plane would descend along the "rest" with the uniform velocity of $\frac{30}{\sqrt{(\sin^3 \theta)}}$ feet per second.

We are now prepared to answer the query proposed by Mr. Lancaster as a crucial test of the validity of his theory, viz., "Will the tilted surface, supplied with the rest of two pounds and moving with uniform velocity, obey the impulse of an external force applied in its own plane with equal facility in any direction?"

The above formula for uniform velocity of descent indicates that, for all inclinations of the plane, there is an unbalanced force which acts downward and parallel with the face of the plane, and therefore toward the "rest." The tilted surface therefore will *not* "obey the impulse of an external force applied in its own plane with equal facility in any direction."

"The implication of the case" therefore is, that if an inclined plane is free to descend through the atmosphere, by virtue of its weight, it will, in consequence of the atmospheric resistance, move *laterally downward* unless it encounters a *current* of air that, being resolved by the under surface of the plane, gives a vertical component which is equal to or greater than the weight of the plane, in which case the plane will move horizontally or ascend; or if the plane is properly shaped it may, in consequence of "rear expansion" of the air, remain stationary with respect to the earth.

It follows that all of the observed phenomena of soaring are in accord with the recognized principles of mechanics, but I trust it is sufficiently obvious, from the preceding discussion, that a soaring bird is *not* "translated at right angles to the gravitating force, or horizontally, solely by the action of that force."

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EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

—— Just as the inorganic appears to have preceded the organic in the history of the phenomena of nature, the inorganic preceded the organic as the most potent factor in the environment in which organic nature developed. Convulsions of inorganic nature were frequent and irresistible in the most ancient periods of time, and they diminished in number and importance as life varied and multiplied. The conditions of the fitness essential to survival were thus originally those of physical endurance, and as life multiplied and inorganic nature receded in importance as a factor, these conditions came to depend more and more continually on intellectual development or adaptation to the wants of the most intelligent organisms. The most useful and successful man in the Plymouth Rock colony was he of the strongest arm and broadest shoulders, but the most useful and successful man of the metropolis to-day is he of the greatest business tact and shrewdness and the broadest human sympathies.

When we speak of the "survival of the fittest," it is obvious that we must keep before our minds a clear idea of the sense in which the words "survival" and "fittest" are used. If the conditions of a certain sense of the word "survival" pass away or indefinitely decrease in relative importance, we cannot reasonably expect to apply the word in that sense as if it were invariable. It is necessary, instead, to employ a more constant and general signification of the word.

If there were no universal and overwhelming convulsions of nature after the arrival of the highest members of the scale of animal life at a plane of absolute intelligence, we are warranted in supposing that the most intelligent mammals, at least, were capable of preserving themselves from destruction and burial by the lesser convulsions of nature that occurred from time to time.

Moreover, if we assume, for the sake of argument, that man descended from the highest development of anthropoid apes whose existence in prehistoric times is known, we must admit the occurrence of a considerable interval between the cessation of such convulsions of nature as were likely to bury and preserve the remains of anthropoid apes and the attainment by the anthropoid of a sufficient degree of intelligence to suggest the burial of the dead in a manner calculated to preserve their remains for modern scientific inspection.

The longer this intermediate period is supposed to be, the greater the intellectual development which, under the laws of evolution, should take place in the course of it. The reasonable inference is that the greater the gap between the highest known form of anthropoid ape and the lowest known form of man, the more important, relatively, must have become the social and moral conditions of development, while the physical conditions dwindled in importance during the period represented by that gap.

If, mathematically speaking, we let *m* represent the product of physical conditions in effecting the variation and development of the organism, and *n* the product of social and moral conditions, we find that *m* varies inversely as *n*. If *m* be infinite and *n* infinitesimal, as at first, and *m* continually diminishes while *n* increases according to definite laws, the attainment of a point at which *m* is infinitesimal and *n* infinite is only a question of time.

The conditions of any possible development of man from anthropoid apes appear therefore to require that there *should* be a "missing link," in the sense that physical evidences of intercalary types are unpreserved. The "survival" of the fittest, at a certain period in the history of life, means exactly such survival as would make it improbable that many remains should be preserved, and this survival only the fittest would, under the circumstances, attain. Such anthropoid apes as were capable of generating man should have been superior to those whose remains were preserved because they had not intelligence enough to protect their lives. The first considerable preservation of primitive man would begin when he ventured on navigation; but his remains so preserved will be "missing," until such time as "the sea gives up her dead."

—— The committee of Congress which has been investigating the U. S. Geological Survey has not dealt kindly with Major Powell and his charge. There is no intrinsic reason why Congress should not be favorable to the Geological Survey, but there is probably no department where it is less likely to tolerate abuses. We cannot say that the survey has been entirely free from faults of this kind. If Major Powell is carrying any Jonahs he had better relieve himself of them.

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RECENT LITERATURE.

A HAND-BOOK OF PLANT DISSECTION.[1]—This long-promised work has at last appeared, and we have no doubt that it will be welcomed by laboratory workers throughout the country. It is apparently an entirely original work, no statements being made at second hand, and no directions for work being given which have not been *actually worked out* by the authors themselves. One finds evidence of this original work on almost every page, and this fact alone will commend the book to all teachers and to every pupil who wishes to become an investigator in structural botany.

[1] *Hand-Book of Plant Dissection.* By J. C. ARTHUR, M.Sc., botanist to the New York Agricultural Experiment Station; CHARLES R. BARNES, M.A., professor of botany in Purdue University, and JOHN M. COULTER, Ph.D., professor of botany in Wabash College; editors of the *Botanical Gazette.* New York, Henry Holt & Company, 1886, pp. XXII, 256, 12 mo, with two plates.

PLATE XX.

Wailuku—Maui.

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The book opens with two plates, illustrating (1) gross anatomy and (2) minute anatomy, and the methods of recording results by means of the pencil or drawing-pen. This is followed by a chapter on instruments, reagents, section cutting, mounting, etc., etc., in which the treatment is refreshingly non-technical. There is a suggestive absence of the usual "microscopical" lingo, and a plainness of statement which cannot help pleasing every reader.

The succeeding chapters take up in order the following plants, viz., green slime (*Protococcus viridis*), dark-green scum (*Oscillaria tenuis*), common pond scum (*Spirogyra quinina*), white rust (*Cystopus candidus*), lilac mildew (*Microsphæra friesii*), common liverwort (*Marchantia polymorpha*), moss (*Atrichum undulatum*), maiden-hair fern (*Adiantum pedatum*), Scotch pine (*Pinus sylvestris*), field oats (*Avena sativa*), trillium (*Trillium recurvatum*), shepherd's purse (*Capsella bursa-pastoris*). A chapter is devoted to each plant, and in the treatment the gross anatomy is first taken up, and afterwards the minute anatomy. Preceding both, however, is a short statement giving such general facts as to habitat, appearance, structure, development, etc., as will enable the student to find the plant and undertake its study with less difficulty.

It will be observed that the work proceeds from the simple to the complex, and that every great branch of the vegetable kingdom is represented by species which may be obtained easily in in any part of the country. The authors have exercised unusual care, as it appears to us, in this matter, and have succeeded in making a list of illustrative plants which even a tyro will have little difficulty in securing wherever he may happen to be.

We would direct the attention of those who are skeptical as to the possibility of beginners studying the lower forms of vegetation to the gross anatomy studies under each species. The things which can be seen in every one of the lower plants will astonish the old-fashioned teacher. Even in the two protophytes (Protococcus and Oscillaria), the authors coolly set the student at work, *first*, with nothing but his unaided eyes, or at most with a simple hand-lens; and he is expected to find out a good deal, too, by such means. We venture the assertion that, considering the almost infinitely greater complexity of shepherd's purse over Protococcus, the latter has far more which can be made out by gross anatomy than the former. If the student can see little in Protococcus with his unaided eyes, or with a hand-lens, it is because there is very little to be seen. The old adage, "a short horse is soon curried," is appropriate here. One must not expect to see as much in Protococcus as in Capsella, but one must not neglect to see the little that is to be seen.

An excellent pronouncing and descriptive glossary, and a full index, complete the volume.—*Charles E. Bessey.*

THE FOURTH ANNUAL REPORT OF THE U. S. GEOLOGICAL SURVEY.—Besides the usual reports showing the progress in the survey by the different members, the body of the volume is filled by the following memoirs: Hawaiian volcanoes, by Capt. C. E. Dutton; Abstract of report on the mining geology of the Eureka district, Nevada, by J. S. Curtis; Popular fallacies regarding the precious metal ore deposits, by A. Williams, Jr.; A review of the fossil Ostreidæ of North America, by Dr. C. A. White; A geological reconnaissance in Southern Oregon, by I. C. Russell.

Having already called attention to Dr. White's valuable essay, we would briefly notice Capt. Dutton's elaborate account of the volcanoes of the Hawaiian islands. Besides detailed descriptions, accompanied by excellent illustrations and maps, of Kilauea and Mauna Loa, the author also describes Mauna Kea and the old extinct volcano of Kohala and the lava fields of Hualalai.

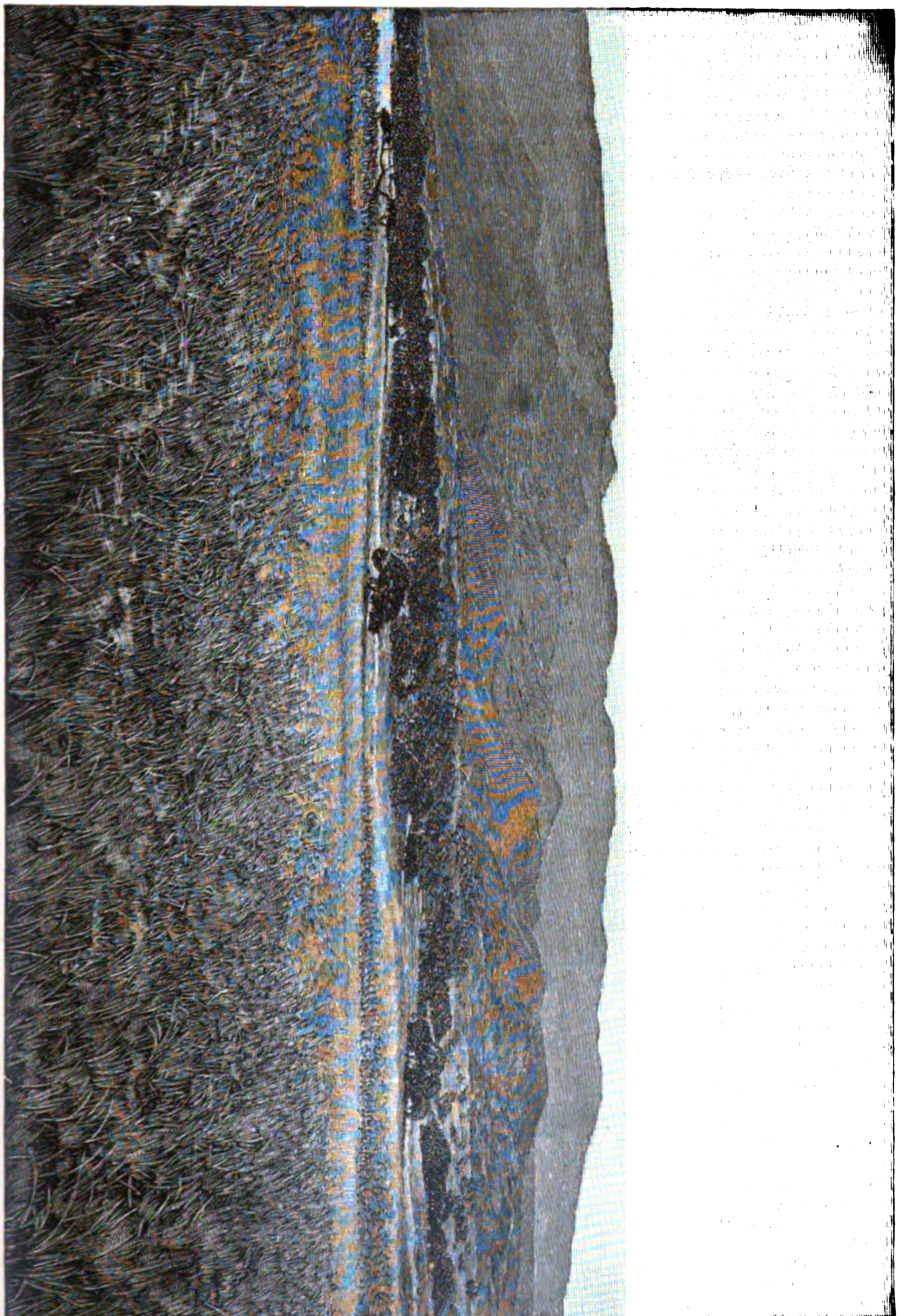
The descriptions of the mountains and lava streams and beds are careful and the facts presented will be important to the student of vulcanism. The author does not regard Kilauea as a crater, but considers the depression in that mountain, which he designates a *caldera*, as due to the "dropping of a block of the mountain crust which once covered a reservoir of lava, this reservoir being tapped and drained by eruptions occurring at much lower levels."

Acknowledging that volcanic action and regional uplifting are really associated phenomena, the author states that the cause is mysterious, the attempted solutions not standing criticism, though suggesting that the effects are due to expansion of the earth's crust in the region involved.

The three plates which we are allowed to reproduce from this volume, will convey some idea of the grandeur and beauty of this volcanic region.

THE ZOOLOGICAL RECORD FOR 1884.—This volume appeared promptly, our notice of it having been delayed. It forms the twenty-first volume of the series, and like its predecessors it is indispensable to all workers in systematic zoölogy, and it is to be hoped that its future publication will be maintained even though heavy sacrifices be made. While members of the Zoölogical Record Association and subscribers receive the volume for £1, the volume is issued to the public at £1 10s. The undertaking is partly supported by a grant of one hundred and fifty pounds from the Government Grant Committee of the Royal Society, and of one hundred pounds from the British Association, but still more subscribers are needed. The Record is now edited by Professor F. Jeffrey Bell, and there has been a number of changes in the list of assistant editors. We regret to notice that Professor E. von Martens, from the first the recorder of Mollusca and Crustacea, has been obliged to resign. His place is taken by

PLATE XXI.



Mauna Kea from the South.

four younger men. The work of compiling such a record as this is a great labor, but is a most useful task, and the results are a great boon to those situated away from libraries. To such the purchase of the Record is earnestly commended. It is published by Mr. J. Van Voorst, Paternoster row, London.

THE AMERICAN ORNITHOLOGISTS' UNION CHECK-LIST OF NORTH AMERICAN BIRDS.[1]—This catalogue of North American birds, as the latest issued, is the most complete, and will be a useful work of reference to ornithologists. The volume also contains a digest of rules of nomenclature adopted by the American Ornithologists' Union. There has always been a large proportion of authors of works on birds with literary rather than scientific tastes, so that the conclusions of an ornithologists' union will require careful scrutiny on the part of the scientific investigator. The danger from the side of letters is the subordination of the true interests of scientific research to red tape and literary archæology. The way to do this is to excuse authors from giving definitions to the new words they introduce, and so to open wide the doors to amateurism and its attendant confusion and redundancy. We are glad to observe that the new code agrees with the old ones in requiring that new generic names shall be defined in order to be adopted. But a few pages later the code contradicts itself by saying that when an author describes a new species which belongs to a new genus, it is not necessary to give a separate description of the genus, although a new generic name may be proposed. The code on this point therefore appears to us to be without authority either way, and we have to rest on the older codes, which require definitions in all cases. Nor do we find the code clear as to the necessity of furnishing definitions for divisions of higher rank.

Another objection we find is that it requires the use of an old specific name when the generic name later proposed is identical with it. Such names are really mononomial, and no more to be adopted than quadrinomial ones. The question is, however, rather one of taste, than of any serious moment.

Apart from these points we concur heartily in the rules of the code.

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[1] New York, American Ornithologists' Union. 1886, 8vo, pp. 392. For sale by L. S. Foster, 35 Pine street, New York city. $3.

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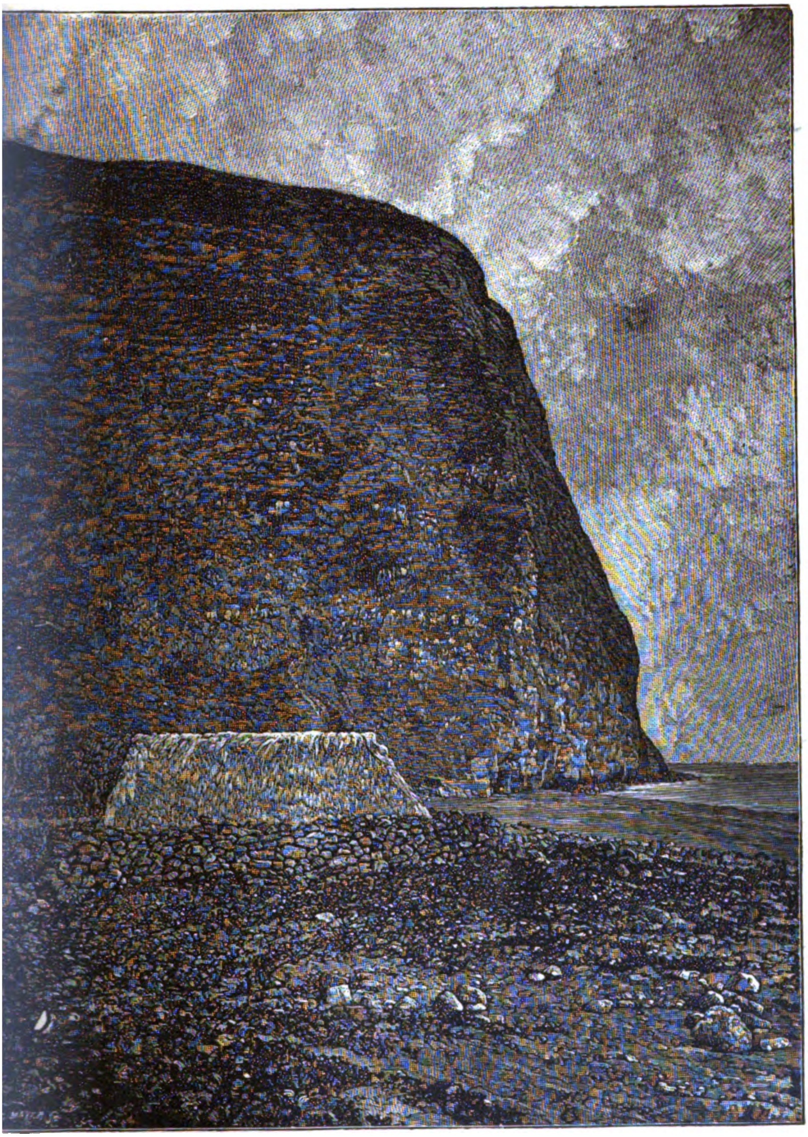
PLATE XXII.



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——Geognostische Excursion nach Dippoldiswalde, 30 Juli, 1885. Both from the author.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

ASIA.—*Railway Projects in the Shan Country.*—Mr. Holt Hallett states that the most practicable line for a railway in Indo-China, to connect India with that country, is up the valleys of the Meh Ping and Meh Wung, tributaries of the Meh Nam, to Kiang Hsen, on the Meh Kong. At Raheng this line would be joined by another from Maulmein, at the mouth of the Salween, in British Burmah. North of Kiang Hsen the railway would be produced along the Meh Kong valley to Kiang Hung, fifty miles from the Chinese town of Ssumao. By taking this route the mass of mountains lying east of the Irawadi is avoided.

The Burmese Shan States east of the Irawadi are believed to contain a million to a million and a half of inhabitants; the Siamese Shan States about two and a half millions, while the Meh Nam valley, south of the latter, has about three and a half millions.

The Shans are described as a cultivated people, free from caste, industrious and energetic, hospitable and frank toward strangers, eager for free trade, and of great capacity as petty traders. The hill-tribes are a hard-working, manly people, good agriculturists and handicraftsmen, great growers of cotton, tobacco, indigo and tea, and extensive breeders of cattle.

There are two races of Lua or Lawa, one of which, the "Baw Lua," is acknowledged to be the aboriginal race. They are found chiefly in the Maing Loongyee valley, and here number about nine thousand.

The Heri-rud Valley.—Dr. Aitchison, naturalist to the Afghan Delimitation Commission, states that the valley of the Heri-rud is extremely fertile, producing magnificent crops of wheat, barley, cotton, grapes, melons and the mulberry tree. Among the trees grown are *Pinus halepensis*, an ash and two elms. The country appears barren and arid in winter, but in spring is covered with

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

plants, which shoot from under-ground root-stocks, bulbs, tubers and rhizomes. Among these are the assafœtida plant (*Ferula scorodosma*), and other Ferulas, one of which yields galbanum, and another is taller than a man on horseback. Forests of pistachio are met with among sand-stone rocks. Manna is collected from a *Cotoneaster* tamarisk, and a thorny pea-shrub called *taranjabin*.

The earliest spring flowers are three Merenderas, followed by a many-colored tulip and several Eremuri (liliaceous). The golden flowers of a Delphinium are collected for dyeing silk yellow. More ordinary plants are two low Artemisias, two species of Ephedra, and numerous Astragali. An Asclepias, which sends up annual stems from an under-ground root-stock, yields a good fiber, which is made into cloth.

Asiatic Notes.—The *Calcutta Englishman* states that Mr. Needham and Captain Molesworth followed the course of the Brahmaputra from Sadiya to Rima, and are able to state authoritatively that the Zayal Chu falls into it.——The expedition dispatched to the Fly river by the Geographical Society of Australasia, in November last, has returned. Reports of the massacre of the party were circulated by two natives, who became panic-stricken at a time when the steamer was surrounded by hostile natives, who threw spears and shot arrows from the banks.——Petroleum appears to abound in Asia. It occurs in Burmah, also near Quetta (Hindustan), and the whole country, from the north-eastern corner of the Black sea, through the Caucasus to Baku on the Caspian, abounds with it.——There is much dispute about the title of Mount Everest, undoubtedly the highest known peak in the world. Mr. D. Freshfield maintains the accuracy of Schlagintweit's observations, and insists on Gaurisankar, "the bright or white bride of Siva," as the native name for the peak, while Devadunga, "the abode of Deity," is that of the group. General J. T. Walker denies that Mount Everest is identical with Gaurisankar. The first name was given by Sir A. Waugh, because no native name could be discovered. Herman Schlagintweit identified it with the Gaurisankar of the Nepalese, but from the description he gives it is obvious that he mistook Makalu (which is nearer to his point of view, and, though 1200 feet lower, appears higher, because of the earth's curvature) for Everest, which he calls Sihsur.

AFRICA.—*Mr. Kerr's Journey to Lake Nyassa.*—W. Montagu Kerr gives in the February issue of the Proc. Royal Geographical Society an account of a journey from Cape Town to Lake Nyassa. The traveler passed through Gubuluwayo, the capital of Lo Bengula, king of the Matabelé, by whom he was cordially received. The next people met with were the Mashonas, who as a race are inferior to the Matabelé. They file a triangular opening between the front teeth, and are armed with bows, ax, and two or three assegais. The women shave the head. They are a persecuted race, dwelling in towns among the fastnesses of the igneous mountains. The next people visited, the Mokorikori, resemble the Mashona. Among the Senga, the women perforate the upper lip, placing therein a ring of ivory or wood, called the *jaga*. By constantly enlarging this, they succeed in making the lip project two and a half inches.

Tete, a flourishing Portuguese town in Livingstone's time, is now half ruined, for the elephant has retreated to the far interior, and the ivory trade is small.

After leaving Tete, Mr. Kerr was deserted by his followers and left alone among a tribe of kidnappers of mixed Zulu and Chopetta origin. The king has absolute power; executions are frequent, and nameless cruelties general. It might have fared ill with the traveler had it not been for a Portuguese hunter.

At length Lake Nyassa was reached, at the mission station of Livingstonia. The station was deserted, and the Ajawas, who remained with the traveler, would not risk their boats on the Shiré. After sixteen days in a deserted hut, he was rescued by M. Giraud, then on his way to the coast.

Lake Nyassa is many feet lower than in 1859, and the Shiré is diminishing in volume.

The Berbers.—M. Foncin (Revue de Geographic, Fevrier, 1886) states that the Berbers are the predominating race in Algeria. Phenicians, Carthaginians and Romans have disappeared, and occasionally the blonde type occurs in Kabylia, and recalls the soldiers of Genseric; the Arab tongue preponderates; yet even the Arab is merged in the ancient Berber race. There are, in fact, only two chief races in Algeria—Arabized Berbers, about 2,000,000 strong, and Berberized Arabs, about 800,000 strong. Moors, Turks and negroes are few and are becoming fewer, but Jews increase. The Berbers are often nomads, and were so in the time of Sallust.

The sedentary tribes are the Kabyles of the mountains east of Algiers, the natives of the Dahra, the Traras and Little Kabylia, the Aurasians of the Aurès, the highest mountain mass of Algeria, and the Ksourians or natives of the oases of the Algerian Sahara, including the people of Mzab. The Tuareg are nomad Berbers.

The Congo.—M. de Brazza thus summarizes the results of his last expedition, which covered a space of two years and nine months. The survey of the Ogowé has been completed; the Alima and the Congo (from the Nkundja to Brazzaville) has been thoroughly surveyed; important topographical and hydrographical work has been executed on the coast of Loango; numerous astronomical observations have been taken at different points; natural history specimens of interest have been extensively collected and a large number of photographs, sketches and ethnographical notes have been brought home.

Almost all the tribes along and between the Ogowé and Congo have been brought under the influence of France, including, to some extent, the cannibal Fahuins.

Mr. Grenfell has made another exploring voyage devoted to the Lulongo and the Boruki, the only rivers of importance that remained unexplored between the Kasai and the Lomame. The Lulongo falls into the Congo in 18° 42′ E. long. and 0° 41′ N. lat. Mr. Grenfell ascended it to 22° 32′ E. long. and 10′ N. lat.; it therefore runs nearly parallel to the main stream. The Boruki is formed by the union of three rivers, one of which, the Juapa, was ascended as far as 23° 14′ E. long. and 1° 1′ S. lat., where it was still an open water-way one hundred yards wide and twelve feet deep.

AMERICA.—*American News.*—Explorations conducted in the Gran Chaco by M. de Brettes have resulted in the discovery of a large salt lake, situated between lat. 25° 57′ .06″ S. and lat. 27° 30′ 18″ S. Three rivers, flowing north and south, probably tributaries of the Vermejo, were discovered. The natives, Chunupis, Velolas and Matacos, are degraded, cruel and hypocritical. The country is flat, covered with thorny trees, marshes and tall, sharp prairie grass.——Dr. Ten Kate has explored the canal connecting the Surinam and Saramacca rivers, ascended the Wayombo, the banks of which are inhabited by the Arrowaks, proceeded for five days up the Nikerie, which flows through a well-wooded but uninhabited region, and returned down the Nikerie and up the Corentin to Oneala.——M. Thouar, according to the *Brazil and River Plate Mail*, has returned successfully from his second journey up the Pilcomayo, and has proved the river to be navigable.

EUROPE.—*European News.*—The German Statistical Bureau gives the population of Berlin in 1885 as 1,316,382. In 1880 Germany had only eight towns of more than 100,000 inhabitants, now it has fourteen.——The Dobruja has an area of about 5766 square miles, about two-thirds of which is productive, the rest marshes and sand with lakes. The official estimates place the population at 150,000.

GEOLOGY AND PALÆONTOLOGY.

THE LONG-SPINED THEROMORPHA OF THE PERMIAN EPOCH.—I have at various times described the extraordinary development of neural spines of the dorsal vertebræ in the genus Dimetrodon, which belongs to the Clepsydropidæ, one of the carnivorous families of the saurian order Theromorpha. The dentition of these animals is of the most formidable character, consisting of compressed, finely serrate teeth on the maxillary and dentary bones mingled with huge conic tusks on the middle of the maxillary, anterior end of the dentary, and occupying the entire alveolar face of the premaxillary. The huge neural spines formed an elevated fin on the back. In a medium-sized specimen of *Dimetrodon incisivus*, where the vertebral body is 35^{mm} in length, the elevation of the spines is 900^{mm} or twenty and a half times as great. The apex of the spine in this species is slender and apparently was flexible. The utility is difficult to imagine. Unless the animal had aquatic habits and swam on its back, the crest or fin must have been in the way of active movements. Accordingly the spines are occasionally found distorted at the union of surfaces of fractures. The limbs are not long enough nor the claws acute enough to demonstrate arboreal habits, as in the existing genus Basiliscus, where a similar crest exists. A very peculiar species has been described under the name of *Naosaurus claviger* Cope. There the spines are not quite so elevated as in the *D. incisivus*, but they are more robust, and have transverse processes or branches which resemble the yardarms of a ship's mast. In a full-sized individual, the longest cross-arms, which are the lowest in position, have an expanse of $260^{mm.}$ or ten and a quarter inches, while the spine has about the height of 500^{mm} (19.75 inches), the body being 60^{mm} long. The animal must have presented an extraordinary appearance. Perhaps its dorsal armature resembled the branches of shrubs then, as they do now, and served to conceal them in a brushy or wooded region. Or, more probably, the yardarms were connected by membrane with the neural spine or mast, thus serving the animal as a sail with which he navigated the waters of the Permian lakes. A very singular character of the spines in all the species is that they are hollow, as in Cœlacanth fishes, and that the central cavity is not closed at the apex.

There is a well-preserved cranium of the *D. claviger*, but the muzzle is unfortunately wanting. The median line rises forward so that the convexity of the top of the muzzle is higher than the posterior parts of the skull, whose profile descends rapidly. This throws the orbit far back and gives the animal a peculiar appearance.

Naosaurus differs from Dimetrodon in the transverse processes of the neural spines of the vertebræ. There are three species, which differ as follows:

Spines of vertebræ cylindrical distally; transverse processes replaced above by tuberosities...*N. cruciger*.

Spines of vertebræ expanded and compressed above.

Palatine teeth large, forming a pavement......................*N. microdus*.[1]

Palatine teeth much smaller and more widely spaced..............*N. claviger*.

All these species are from the Permian formation of Texas. Figures of the *N. claviger* will be published in the Transactions of the American Philosophical Society.—*E. D. Cope*.

[1] *Edaphosaurus microdus* Cope, Proceeds, Amer. Philos. Society, 1884, p. 37.

The Report of the Congress of Geologists.[1]—This publication includes a report of the proceedings of the congress and reports of the several committees appointed to present systems of nomenclature and cartography by the Congress of Bologna. These reports are highly interesting, and display, in an instructive manner, the points of agreement and divergence between the geologists of the different countries of Europe. The digested result will constitute, when completed, the most valuable synopsis of the subject yet written. Unforeseen circumstances prevented the completion of the reports of some of the American committees, and the United States Geological Survey was not adequately represented, although Mr. McGee did his best with the means at his disposal.

The color system adopted is, as it should be, founded on that which has long been current in all countries. The new system proposed by the U. S. Geological Survey was not adopted, but a letter from Major Powell, recommending it, was read. Some of the details for representing details, proposed by Major Powell, might, we think, be introduced with advantage. The important American formations of the Laramie and Puerco must also be represented by appropriate colors. We hope that the Congress of London will make up for these deficiencies, and add to the good work done by the Congress of Berlin whatever may be necessary from other portions of the earth.

The report is well printed and is, in all respects, what was to have been expected of the distinguished secretary of the American Committee.

First Appearance of the Grasses.—At a meeting of the Geologists' Association, held at London, April 2d, J. Starkie Gardner discussed the points bearing on the geological period at which grasses first commenced to assume a preponderating position in vegetation. Their value and importance at the present day were first sketched, and it was remarked that they occupy under cultivation one-third of the entire area of Europe, inclusive of lakes and mountains, while, exclusive of malt and spirituous drinks distilled from them, their products to the value of nearly one hundred millions sterling are imported annually into this country alone. There are over 3000 species fitted to occupy most diverse stations and to overcome nearly every kind of competition under no matter what conditions, with the result that about ninety-five per cent of the plants growing in ordinary meadow-land are grasses. The conclusion arrived at was that there was no great development of grasses until towards the close of the Eocene, no definite remains being associated with any of the older Eocene floras of temperate latitudes. A number of facts

[1] The Work of the International Congress of Geologists of Berlin and of its committees. Published by the American Committee under direction of Dr. Persifor Frazer.

were brought forward to show that grasses could by no possibility have failed to become associated with the remains of other plants in beds deposited under such conditions as those of the Eocene had they existed in any profusion then, while further to support this argument it was stated that the very similar Oligocene and Miocene beds all over Europe are crowded with them. Further, it was shown that the dentition of all the early Eocene herbivorous Mammalia was adopted for crunching fruits, snapping twigs, and grubbing of roots, rather than for browsing on such food as grass, so that the evolution of true Graminivora, as well as the specialized Carnivora that prey on them, must be post-dated to the appearance of the grass itself. The geological history of the whole class of insects was reviewed, with the object of supporting the conclusion arrived at as to the *post* mid-Eocene date of grass. Older remains of grass may, however, occur in the last series of Tertiary deposits in Spitzbergen, but as yet their age has not been accurately correlated. Finally, it was shown that the introduction of an aggressive type in vast numbers and of different habits to pre-existing vegetation, exerted an influence on terrestrial life altogether without parallel, and for the first time rendered possible the development of a meadow and prairie vegetation as distinct from that of marsh, scrub and forest, with all the attendant forms of animal and vegetable life to which such vegetation is indispensable.

GEOLOGICAL NEWS.—*General.*—An orographical and geological map of Turkestan, the work of M. Mouchketoff, has been presented to the Académie des Sciences de Paris, accompanied by a geological description of the Aralo-Caspian steppes.

Carboniferous.—M. B. Renault affirms that the reproductive bodies of Calamodendrons are grains of pollen, which occur in groups of four within four sacs carried by the fertile bracts of the fruit, which recalls that of Annularia. These plants must, therefore, according to M. Renault, be regarded as gymnospermous phanerogams.

Secondary.—R. F. Tomes (*Geol. Mag.*, March, 1886) describes two species of Madreporaria of the genera Thecocyathus and Trococyathus, from the Upper Lias of Gloucestershire.

Tertiary. — R. Lydekker has described the palatal half of the cranium of a large Erinaceus from the Upper Miocene of Œningen. It is closely allied to *E. europæus*, but the describer names it *œningensis.*——The same palæontologist has described the anterior portion of the cranial rostrum of *Melitosaurus champsoides*, a crocodilian from the Miocene of Malta.—— Alfred Bell reviews the succession of the later tertiaries in Great Britain in the *Geological Magazine* for February, 1886. He concludes that Britain was never otherwise than continental from the close of the Middle Red Crag to that of the minor glaciation, also that man came into Britain after the glacial epoch.

Quaternary.—According to Prof. J. N. Woldrich, seven or eight forms of domestic dogs have existed in Europe from alluvial times until now, while four species of diluvial dogs are known. Existing European dogs are therefore not descended from any species of Canidæ now living in Europe, though they may have been crossed with the wolf, fox, or jackal. The so-called feral dogs of Syria may be the remnant of a diluvial true wild dog, the greyhound is said to be certainly descended from a diluvial ancestor of the African *Canis simensis*, and long-eared small dogs may be descended from a diluvial ancestor of the fennec.—— Sir R. Owen has described the premaxillary and scalpriform teeth of a large extinct wombat (*Phascolomys curvirostris* Ow.) from the Wellington bone caves. The animal must have been somewhat smaller than the type of the sub-genus Phascolomys.

MINERALOGY AND PETROGRAPHY.[1]

PETROGRAPHICAL NEWS.—In a "Preliminary paper on an investigation of the Archæan formations of the Northwestern States,"[2] Professor R. D. Irving mentions the results he has reached in the study of the Archæan formations in the region extending from Lake Huron to Southeastern Dakota. These results, as well as those reached by other investigators, have been incorporated in a map which presents in good form the present views held by the author in regard to the distribution of the rocks of this region. The map is accompanied by a report of the work which has already been done in the various districts and a description of the plans to be followed in the solution of problems which are presented in such great number. These problems are all of the very highest importance to a knowledge of the relations which the older formations bear to each other, and to the explanation of the origin of the crystalline schists. The subject of metamorphism in the Huronian rocks is referred to, and a promise is made that before long some publications in this direction may be expected. A microscopical examination of hornblende rocks, occurring throughout the region, seems to point to the conclusions (1) that many of the non-schistose varieties are really changed augitic eruptives; (2) that some of the hornblende schists were originally also augitic eruptives, while others grade into and are associated with the hornblende gneisses. In these the hornblende appears always to be of a secondary nature, every phase being found between schists in which augite excludes the hornblende to others in which the hornblende excludes augite. (3) The so-called actinolite schists are sometimes only the result of extreme alteration of eruptive green stones. The fact of the

[1] Edited by W. S. BAYLEY, Johns Hopkins University, Baltimore, Md.

[2] Fifth annual report of the Director of the U. S. Geol. Survey. Washington: Government Printing Office, 1885.

secondary origin[1] of brown basaltic hornblende is emphasized. The proof relied upon for this belief is, (1) the intimate relation of the two minerals; (2) the occurrence in the hornblende of cores of augite, several of which polarize together; (3) the occurrence of every phase of change from complete augite to complete hornblende, and (4) the nearly invariable coincidence of the occurrence of the secondary hornblende with other indications of alteration.——In a "Note on the microscopic structure of some rocks from the neighborhood of Assouan," collected by Sir J. W. Dawson,[2] Professor Bonney describes[3] gneisses, granites, hornblende schist, quartziferous kersantite and a "schistose rock, not of a highly metamorphic aspect," which "has been made out of a diorite or a hornblende schist." In some of the gneisses structures were observed which the author thinks are characteristic of the older rocks of this nature and very similar to a quartz or a gneiss from the Greenville series, occurring near Papineauville station on the Ottawa river.——Messrs. Michel Lévy and J. Bergeron[4] have recently been at work on the eruptive rocks of the Ronda mountains in the southern part of Spain. They consist principally of norites, lherzolites, tourmaline, granite and diorites. Like MacPherson before them, Lévy and Bergeron think that the serpentines have been derived by the decomposition of lherzolites. This latter rock, by the assumption of anorthite, frequently passes over into norite. The constituents of this are spinel, twins of zonal olivine, twinned anorthite, chromiferous pyroxene in twinning relation with large bands of eustatite and a little black secondary mica. Bronzite often occurs in large crystals, giving the rock the appearance of a porphyrite. Ophitic rocks from the same region are composed of titanic iron, labradorite and pyroxene, with a little olivine in the most basic varieties. The most interesting fact in connection with these rocks is the occurrence in them of a secondary glaucophane with the usual pleochroism. The most ancient schistose[5] rocks are the cordierite gneisses and amphibolites. In a mass of dolomite, intercalated in the gneiss, the following minerals were found in the order of their crystallization: pyrite, ilmenite, sphene, rutile, pargasite, humite, clino-humite, pleonast, anorthite and talc. Following the schistose rocks in age, occur eclogites and crystalline limestone containing metamorphic minerals, among which are epidote, sphene, rutile and scapolite.

[1] Cf. AMERICAN NATURALIST. December, 1885, p. 1215, and G. H. Williams, *Amer. Jour. Sci.*, October, 1884, p. 259.

[2] The *Geological Magazine*, March, 1886, p. 103.

[3] Ib., October, 1884, p. 440.

[4] Comptes Rendus, Mars 15, 1886, p. 640.

[5] Ib., Mars 22, 1886, p. 709.

MINERALOGICAL NEWS.—A. Lacroix[1] has an article in the "Comptes Rendus" on the optical properties of some minerals which are without crystal forms. In it he affirms the discovery by Des Cloizeaux that grünerite is an amphibole and not, as is generally held, a pyroxene. Its cleavage planes make an angle of 124° with each other. The plane of the optical axes is $\infty P \grave{\infty}$ and the bisectrix is negative and inclined 15° to the normal to the orthopinacoid. Pleochroism is feeble and twins are abundant. Warwickite is a borotitanate of iron and magnesium. Its crystal system is not positively known. A microscopical examination makes it appear orthorhombic, with a pleochroism in three shades of brown. The plane of the optical axes is $\infty P \bar{\infty}$, the bisectrix being positive and normal to this, which is the direction of easy cleavage. Withamite, xantholite, scoulerite and chalilite are identified respectively with piedmontite, staurolite and thomsonite, of which the latter two are but impure varieties.——Some interesting manganese minerals are described by Weibull[2] from the Wester-Silfberg mine in Dale Karlien, Sweden. A manganese magnetite gave on analysis 6.27 per cent of MnO. It is uncrystallized and is associated with masses and grains of manganocalcite. The massive variety contains 6.98 per cent of MnO and the granular mineral 24.32–24.89 per cent. A careful examination of Igelströmite[3] ($2Fe_2(Mg)SiO_4+Mn_2(Mg)SiO_4$) proves it to be orthorhombic, with the optical axes in the plane of the base and the *a* axis the negative bisectrix. Pleochroism: $\mathfrak{b}$ = grayish-yellow, $\mathfrak{a}$ = grayish-yellow-white, $\mathfrak{a}$ = yellowish-gray. Absorption, $\mathfrak{a} > \mathfrak{b} > \mathfrak{c}$. Silfbergite, first described by Weibull[4] in 1883, is further investigated. Its crystals are bounded only by the planes ∞P and $\infty P \grave{\infty}$, parallel to which the cleavages run. In polarized light these crystals are seen to be composed of twinned lamellæ with the orthopinacoid the twinning plane. The plane of the optical axes is the plane of symmetry, and the double refraction is negative. The pleochroism is marked, $\mathfrak{c}$ = dirty brown, $\mathfrak{b}$ = brownish-yellow with a green tinge, $\mathfrak{a}$ = yellow white. Absorption, $\mathfrak{c} > \mathfrak{b} > \mathfrak{a}$. An analysis of a pure variety gave:

SiO_2	FeO	MnO	MgO	CaO	Al_2O_3	H_2O
49.50	30.69	8.24	8.10	2.02	.69	.40

In the same article the author reports the result of a re-examination of the Knebelite of Dannemora. This mineral occurs in columnar masses of black to blackish-gray individuals, with three cleavages, one parallel to the faces of a prism of 50° 6′, very perfect, and the other two parallel to the brachy and macro-pinacoids. A parting perpendicular to the three cleavages was also

[1] Comptes Rendus, CII, Mars 15, 1886, p. 643.
[2] Mineralogische und Petrographische Mittheilungen, VII, 1885, p. 108.
[3] Cf. Zeitschrift f. Kryst., VIII, p. 647.
[4] Geol. Fören. Förhandl, VI, p. 504.

observed. The relation of the horizontal axes is 0.467:1. The axial plane is the base, with the *a* axis the negative bisectrix. The pleochroism is strong, $\mathfrak{a} + \mathfrak{b}$ yellowish-gray, $\mathfrak{c}$ = grayish-white. $\mathfrak{a} > \mathfrak{b} > \mathfrak{c}$. The analysis of Knebelite would indicate that it is a manganese olivine, with most of the optical properties of this mineral.

BOTANY.[1]

VARIATIONS OF TRADESCANTIA VIRGINICA.—An interesting case of floral variation is under observation by the writer in the shape of a highly aberrant form of *Tradescantia virginica*, or spiderwort, also called, in quaint allusion to the ephemeral nature of its petals, "widow's tears." Said plant presents, as the result of thirteen years' cultivation, the curious aspect of a monocotyledonous plant having in bloom, at the same time, flowers of dimerous, trimerous, tetramerous, pentamerous, hexamerous and heptamerous types respectively, each flower having twice as many stamens as sepals, petals or carpels of ovary. The plant was set out in 1872 and received very rich treatment, so that it gave forth blossoms measuring two inches in diameter. In 1874 it began to deviate from the original trimerous type and to assume the tetramerous one, by developing another petal, and instead of doing this at the expense of the pistil or stamens, it *added* another sepal, another carpel with style, and two stamens, thus making a typical tetramerous flower. The plant has since then continued to differentiate in a greater degree each succeeding year, the differentiated forms being typical plants and maturing seed capable of perpetuating and possibly increasing the differentiation. The seed of differentiated forms gives plants having a large number of aberrant forms, while that of normal flowers gives a few abnormal forms, showing that the plant is working out a plan of evolution. The original trimerous plant was set out in 1872; in 1874 the tetramerous plant was evolved; in 1876 the pentamerous; in 1879 the hexamerous; in 1882 the dimerous; and in 1884 the heptamerous. Of these differentiated forms, as observed last year, the most plentiful were the *pentamerous* flowers, giving a complete refutation to the dictum, "Endogens *never* have the parts of the flowers in *fives*."

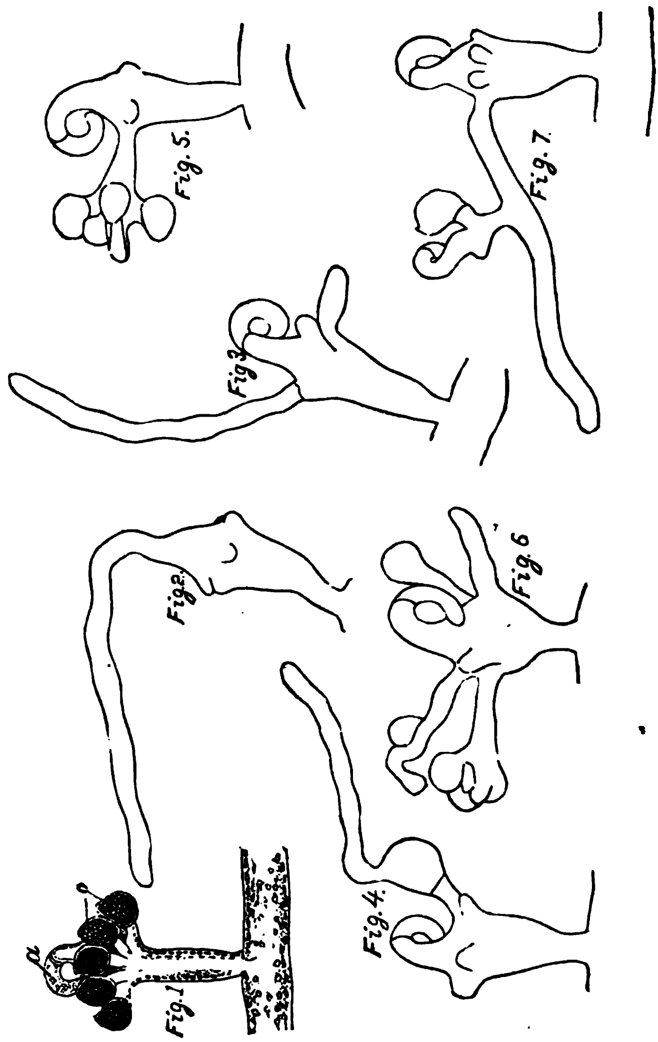
The dimerous and heptamerous types are as yet but few, as they are struggling for existence. The hexamerous and heptamerous flowers occasionally show an imperfect carpel, and in one case a heptamerous flower had an octamerous ovary with two imperfect carpels, showing that seven is evidently not the limit of differentiation. A number of interesting experiments have been made regarding the intensity of variation, showing that it is very pronounced.

Roots of this plant and seeds from trimerous, tetramerous,

[1] Edited by Professor CHARLES E. BESSEY, Lincoln, Nebraska.

hexamerous and pentamerous forms have been sent to Dr. Asa Gray for cultivation, at his request.—*G. A. Brennan, Roseland, Ill.*

Some abnormal Forms of Vaucheria.—While engaged in the study of Vaucheria with my classes in botany, some weeks since, my attention was called to some very curious abnormal develop-



Abnormal forms of Vaucheria.

ments that seemed to me worthy of record. The commonest species of Vaucheria in the neighborhood of Detroit is *V. geminata* Vauch, var. *racemosa*, and it was in this species that the abnormal growths referred to were observed.

The ordinary form of the fertile part of the plant is shown in Fig. 1. The sexual organs arise as buds upon a common branch, the single antheridium being terminal and decidedly curved; the oōgonia varying in number from two in the typical form of the species to eight or nine in some specimens of the variety. They are arranged in a circle about the base of the antheridium (Fig. 1, *o*).

The specimens when first collected showed no peculiarities, but after being kept for a week or two in rather confined quarters, a large proportion of the fertile branches developed abnormally, owing no doubt to the unnatural conditions in which the plants were grown.

The accompanying figures will show the more peculiar cases observed. In all of these it will be seen that the branches that under ordinary circumstances would develop into the sexual organs are here variously modified.

In Fig. 2 the antheridium is replaced by a filament that is in all respects like an ordinary vegetative filament.

In Fig. 3 the antheridium is perfect, but the oōgonia are replaced by slender filaments.

In Fig. 4 one oōgonium has developed, but its apex is prolonged into a filament like those in Fig. 3.

In Fig. 5 the antheridium is complete, but one of the lateral buds has developed a secondary branch bearing a complete set of sexual organs, a perfect antheridium and four perfect oōgonia.

Fig. 6 shows a case where in addition to the ordinary antheridium two others are developed with accompanying oōgonia from the lateral buds.

In Fig. 7 one of the lateral buds has grown out into a filament which bears laterally a smaller branch upon which a perfect antheridium and oōgonium and a rudiment of a second oōgonium were formed.—*Douglas H. Campbell, Detroit, April, 1886.*

Botany in Winter.—In connection with the subject of "Teaching botany in winter," treated recently, though briefly, in the American Naturalist, I would like to say a few words. My sophomore class of over fifty members begins its second term in botany the last week in February. The college vacation is during December, January and most of February. The sophomore class has had one term of botany as freshmen in the previous autumn. The class meets twice each week in both the freshmen and sophomore years, and a field exercise is required between each meeting. During the autumn the class study first leaves, next flowers and later in the season fruits. Any botanist will at once note the special facilities for the study of fruits. The class comes to the sophomore work in February, having had very little concerning stems and buds. The first field exercise for this year was the making of a careful drawing of at least three inches of the tip of an elm and of a maple branch. The students were given no further instruction. They are never told what to look for. From my pile of sketches and descriptions I quote the whole of the first one without making any selection:

"1. Drawing of maple branch with terminal and opposite lateral buds. Stem thick and of a red color, covered with small specks. Wood not so tough as elm. Buds more tender. 2. Drawing of elm twig with a terminal bud and alternate lateral buds. Wood compact and tough. Buds appear to be better protected from weather than maple." The drawing, if not the description, would indicate that the maple is *Acer dasycarpum*.

For the next field work each member of the class was requested to make a study of the last year's growth of a branch of each of two kinds of Acer. What is Acer? was one of the first questions each member answered for himself. This lesson brought out the specific peculiarities of members of the same genus—peculiarities not easily found in books within the reach of students. One of the first duties of a teacher in natural science is to keep students away from printed descriptions. They must go to the objects and make their own descriptions. I quote again from the first paper:

"The bark of No. 1 is of a lightish color and it is difficult to tell a year's growth, while that of No. 2 is of a red color and it is very easy to recognize a year's growth, as there is a marked difference in the color. The coverings of the buds of No. 1 are much more scaly than those of No. 2, and they are also more closely attached to their buds than those of No. 2 are attached to their buds. The internodes of the first are much shorter than those of the second. The year's growth of the first is shorter than that of the second, as it grows more slowly."

Much better work than this is found on several papers. The "chance selection" is not far below the average. The following questions were given the class at its next meeting and written answers handed in: (1) Have you observed any branching on the last year's growth? (2) What are the differences in the buds of the two maples? (3) Give number of buds on year's growth of each. (4) Relative size, flexibility and strength of the two kinds of twigs. (5) Where are the flower-buds? The fourth question opened the eyes to many important subjects, and the fifth set them in search of the promises of blossoms on the twigs. At this meeting two microscopes were so placed that each student of the large class could look in as he filed out of the lecture-room at the close of the exercise. Under the first instrument was shown a longitudinal section of a fresh leaf-bud, and under the second a like view of a flower-bud, both of the lilac. It may be stated here, in passing, that each member of the class gets either one or two microscopic views in the above way at each meeting.

Without here fully following out the course, it may be said that after the buds and branches had been canvassed we took up the evergreens, and as a first lesson each student made a drawing of a branch of any pine and any spruce he might choose. This was followed by a study of two species of Pinus, which brought out the characteristics that pertain principally to branches and their leaves. The study of the evergreens being disposed of, in of course only a general way, the class took as a single field exercise the following: Make a study of a branch bearing thorns and of another bearing prickles.

It would be a pleasure to reproduce here the descriptions on a dozen papers, but already these notes are far longer than they were expected to be at the outset. Here is one, however:

"No. 1 has large spines or thorns situated just above the lateral buds. These thorns are branched, having small thorns very much like the original one, only smaller. One of these thorns has two small ones upon it situated nearly opposite each other. No. 2 has many prickles, with three on each internode. They appear to have a definite arrangement with respect to each bud, one being situated a little to the left of and below the bud, another is a little farther down on the stem and to the right; the third is much farther down and directly under the bud. The prickles are quite large at the base, but easily broken off from the bark. Many of them have fallen off. Prickles grow on the bark and have no union with the wood, and come off on the bark when the branch is peeled. The thorns are connected with the woody structure."

To-day (March 28th) the class brought in their work upon the study of pith. The directions given were as follows: Study the stem of a plant with a large pith and one with a small pith. The two stems are to be of the same diameter. Make a cross-section of each stem and draw them four times enlarged, showing all the parts. Make radial section lengthwise and draw as for cross-section.

Each student collects his own material. A specimen paper, of course without the drawings, is submitted:

"The linden (No. 1) has a small pith about $\frac{1}{32}$ inch in diameter, situated at or near the center. The relative thickness of wood to pith, in No. 1, is about one to seventeen, and in No. 2 (elder) it is about three to five. The distance from the surface of the bark to the pith, in No. 1, is about $\frac{5}{16}$ inch, the stem being a little more than $\frac{5}{8}$ inch in diameter. In No. 2 the distance from the surface of the bark to the pith is nearly $\frac{3}{16}$ inch, the diameter being about the same as that of No. 2. The pith in the latter is not so firm as that of No. 1, and seems to be made up of larger cells. The middle layer of bark in No. 1 is of a greenish color, that of No. 2 has brown spots which seem to alternate with spots of white. These spots are mostly triangular in form, with the base next to the wood."

Work of the nature above pointed out will be continued until the spring flowers come, when each student is prepared to make an herbarium of plants collected and determined by himself. It is doubtless true that the work in the fall term helps in the field work herein mentioned, but there is no question that students with no knowledge of plants can take hold of botany in the winter and do excellent, interesting work—work that is at the foundation of morphology and gross anatomy, the fresh material for which is in better condition than during the growing season when buds are forming and branches and leaves obscure the view.—*Byron D. Halsted.*

ENTOMOLOGY.

A CARNIVOROUS BUTTERFLY LARVA—PLANT-LICE FEEDING HABIT OF FENESICA TARQUINIUS.[1]—One of the most interesting of our butterflies is that known as *Fenesica tarquinius*, a unique Lycænid having the wings above brown-black in color with conspicuous orange markings both on primaries and secondaries. It has a wide geographical range, occurring very generally over North America as also in Asia.

Donovan, in his "Insects of India" (Pl. XLIV, fig. 1), illustrates the butterfly rather poorly, but says nothing about the larva.

Boisduval and LeConte (Hist. des Lép. et des Chen. de l'Am. Sept., p. 128, Pl. XXXVII) figure the larva, pupa and imago under the name of *Polyommatus cratægi*, and simply quote Abbot as stating that the larva lives on several species of Cratægus.

Scudder (Proc. Essex Inst., Vol. III, p. 163, 1862) treats of it under the name of *Polyommatus porsenna* (Syn. List of Am. Rurales, Bull. Buff. Soc. Nat. Hist., III, p. 129, May, 1876) and gives the food-plants of the larva as Alnus, Ribesia, Vaccinium and Viburnum. Later, in the AMERICAN NATURALIST for August, 1869, he gives the food-plants as follows: "Probably arrow-wood, elder and hawthorn."

Grote (Trans. Am. Ent. Soc., II, p. 307) first proposed the generic name of Fenesica, but says nothing about its larval history.

Strecker (Butt. and Moths, etc., Diurnes, p. 103) repeats simply from Scudder; while Wm. H. Edwards, in his admirable life-histories of butterflies, has not so far treated of this particular species. In short, so far as the published records go, it has been generally assumed that the larva feeds upon the plants named.

The object of this brief communication is to show that in this larva we have one that is truly carnivorous, a fact which is extremely interesting because, so far as I can find, there is not another recorded carnivorous butterfly larva; and Mr. Scudder, who has given great attention to the butterflies, writes me in a recent letter, in reply to an inquiry on this point, that he cannot recall any mention of such. Quite a number of Heterocerous larvæ

[1] Abstract of a paper by C. V. Riley, read Feb. 20, 1886, before the Biological Society of Washington.

are known to be carnivorous by exception, and not a few are so as a rule. These are chiefly found among Pyralids, and it is not necessary for my present purpose to refer to the cases in detail.

For some years now I have been studying the remarkable life-habits of the Aphididæ and especially of some of the gall-making and leaf-curling species of Pemphiginæ.

In the collecting of material and making of observations, I have been assisted by Mr. Th. Pergande, who has on a number of occasions, since 1880, found the larva of this Fenesica associated with various plant-lice. Among the species with which it has been thus found associated are *Pemphigus fraxinifolii* Riley, which curls the leaves of Fraxinus; *Schizoneura tessellata* Fitch, which crowds upon the branches of Alnus; and *Pemphigus imbricator* Fitch, which congregates in large masses on Fagus. All these species produce much flocculent and saccharine matter.

The frequency with which this larva was found among these plant-lice justified the suspicion that it feeds upon them or derives benefit from them; yet up to 1885 the presumption was that it benefited from the secretions of the plant-lice rather than from the insects themselves. Last fall, however, Mr. Pergande obtained abundant evidence that the Fenesica larva actually feeds upon the Aphidids, and I thought it worth while to call attention to this positive proof of the carnivorous habits of the species. That the different species of plant-lice are the normal food of this larva is rendered more than probable for the following reasons:

1. Attempts to feed the larva upon the leaves upon which it was found have proved futile, the larva perishing rather than feed upon them.

2. The food-plants given by the authorities are such as are well known to harbor plant-lice.

3. Mr. Scudder's authorities, as he informs me, were picked up here and there and one of them for alder, which he recalls, viz:, a Mr. Emery "found it more commonly on a limb among plant-lice."

4. Mr. Otto Lugger has frequently observed the larva around Baltimore, among *Pemphigus imbricator* on beech, but never dis-associated from the lice, and Judge Lawrence Johnson also found it in connection with the same species around Shreveport, La., last fall and surmised that it might feed upon the Pemphigus, but neither of these observers were able to get positive proof of the fact.—*C. V. Riley*.

WITLACZIL ON COCCIDÆ.—Dr. E. Witlaczil completes his notes on the plant-lice by an interesting article on the Morphology and anatomy of the Coccidæ, in *Zeitschr. f. Wissen. Zoologie*, Vol. XLIII, pp. 149–174. At first both the male and the female larvæ possess limbs, antennæ and simple eyes, which are subsequently lost by both sexes, the females degenerating so as to become wax-covered, immovable forms, and the males acquiring an improved edition of all these organs, with wings superadded. The antennæ and wings of the males arise as evaginations from invaginal disks, are afterwards withdrawn during the quiescent or pupal stage, to be finally driven out again on reaching maturity. Contrary to the usual way in Hemiptera, these males undergo complete metamorphosis. The waxy coat of the female consists not of the larval cuticles that were shed, but of variously crumpled and felted wax filaments emitted by dermal glands, and enclosing the remains of the cuticles. The embryological development is much as in Aphides, but the eggs have no pseudo-vitellus.

Some notes on the Chermetidæ are appended to the article, especially on *Chermes abietis* and on Phylloxera. He kept the galls of Chermes, in autumn, till the parthenogenetic females escaped, of two varieties, some yellow, others nearly black. The female oviposited on the needles of a pine-branch in a heap. After this operation the mother died, protecting the eggs with her shrunk body and wings. In spring large wingless females were found on the pine-shoots, having remained over winter. Each had thirty to forty egg tubules, with two to four well-formed eggs; and the eggs had a pseudo-vitellus. The eggs were laid in masses at the base of the young pine-shoots; the masses of eggs being covered with wax and with the carcass of the mother. The young issuing from these eggs moved to the axils of the needles, and together formed the nucleus of a cone-like gall; by their sucking the needle swells, coalescing with the gall. It is not the swelling of the needle, but of the branch that causes the gall; and this is due to the piercing action of the larvæ, not of the mother.—*G. Macloskie.*

THE ORIGIN OF THE SPIRAL THREAD IN TRACHEÆ.—A CORRECTION.—Since the article on this subject was published in the May NATURALIST, I have examined more specimens of insect tracheæ, in which the "spiral thread" seems to be present; but I do not think the tænidia invariably form a continuous spiral thread. In the axils of the branches we see short spindle-shaped tænidia; and each branch has a separate "spiral thread." In certain fine tracheæ of the eyes of the fly no spiral threads are developed, judging by Hickson's researches. Where the thread is continuous it may be called a *tænidium;* when only separate rings are developed they may be called *tænidia.* I think, however, that I have demonstrated the nuclear origin of the "spiral thread," and that the elongated filamental nuclei of the endotrachea coalesce to form the spiral *tænidium.*—*A. S. Packard.*

DESTRUCTIVE LOCUSTS IN TEXAS.—During the past winter the eggs of some species of locusts were reported by Mr. R. T. Flewellen, of Houston, Texas, to occur in great numbers in Washington county, and fears were expressed of great injury, this season, from the resulting locusts. Professor Riley, of the Department of Agriculture, has had the matter investigated and it appears that the young locusts, which are now all hatched, turn out to be one of the larger wide-spread species, viz., the differential locust (*Caloptenus differentialis*). This species has at times been very abundant in Illinois and in other States but, according to its past history, there is no danger of its ever becoming so serious a pest as the Rocky Mountain locust, and hence Professor Riley believes there is no occasion for alarm.

ENTOMOLOGICAL NEWS.—At a recent meeting of the London Entomological Society, the venerable Professor Westwood remarked that an insect (*Machærota ensifera* Burm) in Ceylon, allied to the frog-hopper (Aphrophora), instead of being enclosed in a liquid (cuckoo-spittle), formed a case by the rapid hardening of the liquid secreted.——Dr. Geo. Marx, artist of the Agricultural Department, publishes in *Entomologia Americana* for May, a description of the male of *Gasteracantha rufospinosa* from Florida, with excellent figures of the two sexes. Although 170 species of this genius are known, the males of only two species have been hitherto discovered. The male differs much in shape, besides being less than one-quarter as large as the female.——In Bulletin No. 5 of the Cal. Acad. Sciences, T. L. Casey revises the California species of Lithocharis and allied genera of Staphylinidæ.——The Transactions of the American Entomological Society, XII, Nos. 3, 4, complete an excellent volume. They contain a thorough monograph of North American Chrysididæ, by S. Frank Aaron, illustrated by five plates; a monograph of the earlier stages of the Odonata, subfamilies Gomphina and Cordulegastrina, by Dr. H. A. Hagen; and a useful bibliographical and synonymical catalogue of the North American Cynipidæ, by Mr. W. H. Ashmead, with description of new species. Appended is a list of species peculiar to designated trees and plants, the greater number, as is well known, living on the oaks.

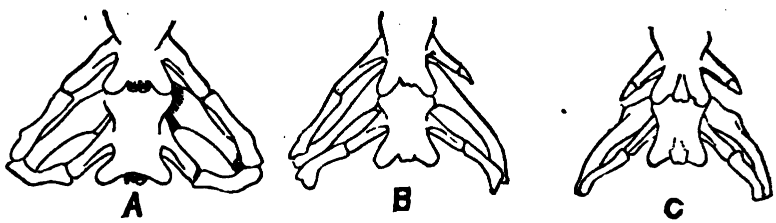
ZOOLOGY.

SELF-DIVISION IN SEPTIC MONADS.—In Dr, Dallinger's annual address before the Royal Microscopical Society, Feb. 10, he detailed the results, which are published in full in the journal of the society for April. Four forms were selected for study. In each of the four organisms the facts were discoverable in the development of the nucleus, the origin of the flagella and the growth of the body. They were best seen in *Tetramitus rostratus* and *Polytoma uvella;* not quite so well in *Dallingeria drysdali*, and least perfectly in *Heteromita rostrata;* but in all they were seen with sufficient clearness to leave no doubt. Each of these septic organisms terminates a long series of fissions with what is practically a generative act of fusion. The last two of a long chain of self-divided forms fuse into one, become quite still, and at length the investing sac bursts and a countless host of germs is poured forth. The growth of these germs into forms like the parent was continuously watched, showing gradual enlargement and ultimate, but as to time somewhat uncertain, appearance of the nucleus, and the somewhat sudden appearance of the flagella or thread-like motor organs, the latter being found in each instance to arise in the nucleus. Very soon after the adult stage is reached the act of self-division commences, and is kept up for hours in succession. The delicate plexus-like structure becomes aggregated at one end of the nucleus, leaving the rest perfectly clear, except that a faint beading is seen in the middle line, with two or three fine threads from it to the plexus. Then occurs the commencement of partition of the nucleus, followed by a slight indication of division of the body-substance. Quickly afterwards the nucleus becomes completely cleft, and the body-substance follows suit. Then the plexus-like condition is again diffused equally over the whole nucleus. When the generative condition is approached by the last generation of a long series of dividing forms, it is remarkable that the organism becomes amœboid, showing how far-reaching is the amœboid state. In this condition, when two such forms touch one another, they coalesce and fuse into each other almost as though two globules of mercury had touched, until nucleus reaches nucleus and two melt into one, and the blended bodies become a globular sac, which ultimately emits an enormous number of germs. Previous to the blending it is now made out that all traces of plexus-like structure are lost in the nucleus, which becomes greatly enlarged and assumes a milky aspect, and shows no trace of structure throughout the process of fusion. Afterwards it begins to diffuse itself radially through the body-sarcode until every trace of the nucleus is gone, and the still globule of living matter becomes tight and glossy, but no trace of structure can be anywhere found in it. In this condition it remains for six hours, when it emits the multitude of germs. After giving similar details about several other organisms, Dr. Dallinger summed up thus: "One thing appears clear, the nucleus is the center of all the higher activities in these organisms. The germ itself appears to be but an undeveloped nucleus, and when that nucleus has attained its full dimensions there is a pause in growth, in order that its internal development may be accomplished. It becomes practically indisputable that the body-sarcode is, so to speak, a secretion, a vital product of the nucleus. From it the flagella originally arise; by it the act of fission is initiated and in all probability carried to the end; the same is the case with fertilization and the production of germs. We are thus brought into close relation with the behavior of the nucleus in the simplest condition. No doubt far profounder and subtler changes are concurrently proceeding. We, of course, are no nearer to the solution of what life is. But to come any distance nearer to a knowledge of how the most living part of the minutest organisms acts in detail has for me, and for most biologists, an increasing fascination."

Blue Color of Animals.—Professor F. Leydig says that a blue granular pigment is rarely found in animals; in the crayfish, for example, there are blue crystals. The blue color is more often due to interference, owing to the presence of lamellæ, or to the fibrils of connective tissue, as in the tapetum fibrosum of the eye of ruminants; the corium of the living larva of *Pelobates fuscus* is similarly blue. A dull material overlying black pigment produces blue, as in the case of blue eyes, which are due to the urea shining through the non-pigmented iris, and in some frogs. Dark chromatophores have a like effect, as has too the swelling of the corium consequent on the filling of the lymph-spaces. In conclusion, the author discusses the tegumentary secretions, which are of various colors, and which can be washed away; an example is to be seen in the celestial blue color of the abdomen of *Libellula depressa* and, perhaps, the "bloom" of the pupa of the Apollo butterfly. On the other hand, the coloring matter may be in cells of the epidermis, as is the case with the rosy color of *Tetrao urogallus*, and can then, of course, only be removed after the destruction of the tissue which contains it.—*Journ. Roy. Micr. Soc., April, 1886.*

Perception of Brightness and Color by Marine Animals.—Professor V. Graber has made some further experiments on marine animals with the divided box already used by him. He finds that the common star-fish is an eminently leucophilous or light-loving animal, for the bright division of the box always contained 2.2 as many individuals as the dark; they avoid red, or are erythophobes, three times as many seeking a dark-blue compartment. The common jelly-fish (*Medusa aurita*) was neither specially sensitive to brightness nor to color; but it is possible that the results might be different with larger aquaria. *Idotea tricuspidata* is very sensitive to light at the maximum differences in brightness, for 6.3 as many individuals sought the white as the dark compartment; but they are quite insensitive to less marked differences. They object to red and like blue. *Gammarus locusta* does not seem to be affected by light or shade. *Rissoa octona* dislikes the dark and is sensitive to less marked distinctions; it again, in the proportion of 103 to 2, liked blue and avoided red. *Gasterosteus spinachia*, like fresh-water fishes, prefers darkness in the proportion of 78 to 6, and *Syngnathus acus* gave somewhat similar results.—*Journ. Roy. Micr. Soc., April, 1886.*

The Sacrum of Menopoma.—In a recent paper read before the Biological Society of Washington, Mr. F. A. Lucas drew attention to the fact that the figure of the pelvis of Menopoma in the article Amphibia, ninth edition of the Encyclopædia Britannica, must have been drawn from an abnormal specimen. The figure and accompanying text credit Menopoma with two sacral vertebræ, but an examination of ten specimens failed to show the occurrence of more than one. An abnormal specimen in the possession of Professor H. A. Ward showed an intermediate condition between the figure in the Enc. Brit. and the normal sacrum, having the right ilium attached to one vertebra, and the left to two vertebræ. Mr. Lucas further called attention to the variation in the number of dorsal vertebræ in certain Urodeles. Menopoma may have 19 or 20 pre-sacrals; Necturus, 18 or 19. Siren may have 41, 42 or 43 pre-caudals; Muraenopsis, 64 or 65. The total number of vertebræ in two perfect skeletons of Siren was 101 and 108; in three perfect Muraenopsis, 105, 107, 111.



A, specimen with two sacral vertebræ, fig. 2, article Amphibia, Encyclopædia Britannica, 9th ed.; *B*, specimen normal on right side, two sacrals on left—drawn by H. L. Ward from a skeleton in the possession of H. A. Ward; *C*, normal specimen.

ZOOLOGICAL NEWS.—*Vermes.*—M. J. Perrier announces as the result of his studies of the Trematoda (Archives de Zool. Experimentale, 1885) that the muscles divide at their extremities, the divisions being inserted upon projections of the inner side of the cuticle. The suckers have a more developed muscular system than has hitherto been admitted; since they are completely enveloped by one or two elastic membranes upon which the muscular bundles of the organ are fixed and are also subject to the action of exterior muscles. There is often a mass of glandular cells in the external layer of the parenchyma. The digestive tract is always covered internally by a layer of elongated cellules united only at their base. The canal of Laurer is not a vagina, but a canal of safety, permitting of the discharge of any too abundant genital products. From the disposition of the external orifices external self-fecundation is the only mode of fecundation possible. The spongy cords found in all Platyelminths are certainly nerve fibers, and the large multipolar cells are nerve cells.——Dr. von Linstow describes (Arch. f. Natur., 1885, part III) several new Nematodes and Trematodes.

Echinoderms.—M. Ed. Perrier contributes to the Annales des Sciences Naturelles an account of the echinoderms collected by the *Travailleur* and *Talisman*. These include several Brisingidæ and Stichasteridæ; species of Cribrella and Solaster; several Pterasteridæ, a family almost entirely confined to great depths; many Goniasteridæ, and some Archasteridæ and Porcellanasteridæ. Asteriadæ and Asterinidæ are almost wanting, Linckiadæ entirely so. Sixty-four species is the total, of which fifty are new.

Mollusks.—The Archiv. für Naturgeschichte for 1885 (part III) contains remarks upon the post-embryonal development of the Naiadæ, by Fred Schmidt.——In a second article upon the molluscan fauna of Behring's sea (Arch. f. Naturgeschichte, 1885, part III) A. Krause enumerates sixty-six Gastropoda, including several new species and three Pteropods, one of which is new.

Mammals.—Dr. E. L. Trouessart (Ann. d. Sci. Naturelles) supports his previously-expressed views that the musk-rat of the Antilles should be placed in the genus Hesperomys, but made the type of the sub-genus Megalomys. The form of its teeth will not permit it to be ranged under the sub-genus Holochilus, which is by Mr. Thomas considered to be a genus. *Megalomys pilorides* has as yet been found only in Martinique and St. Lucia. It reaches the size of a rabbit, and did great damage to the plantations. Systematic war waged upon it by the colonists has almost, if not quite, brought about its extinction, so that the examples in the Paris Museum are perhaps all that is left of this curious and interesting species. [The name Megalomys is preoccupied.–*Ed.*]

EMBRYOLOGY.[1]

1. The Development of Patella.—Dr. William Patten,[2] of Boston, while working in Claus's laboratory at Trieste, succeeded in artificially fertilizing the ova of a species of Patella, the specific name of which is not given. The ova measured 0.12^{mm} in diameter; bluish-green in color and opaque. Acetic acid and glycerine were used to render them transparent enough for a study of the general external characters. The internal changes were studied by means of sections. The eggs were matured from the first of November to the middle of January.

The ova were covered by a very thick transparent chorion, traversed by fine pore canals. The micropyle was a wide crater-like opening in the chorion at one pole of the egg; within this opening were a number of highly refractive globules which greatly interfered with the observation of the fecundation and formation of the polar globules. Ten minutes after removing the ova from the ovaries, the pole globules appear as two colorless and transparent prolongations arising from the surface of the ovum at the bottom of the crater-like micropyle. The polar cells are of great

[1] Edited by John A. Ryder, Smithsonian Institution, Washington, D. C.

[2] The Embryology of Patella. Arbeiten aus dem Zool. Inst. zu Wien. Tom. VI, Hft. 2, pp. 149–174, pls. I to V, 1885.

size as compared with those of other types. Two polar globules arise side by side and not one beneath the other, as in other cases. As many as five distinct polar globules were extruded in abnormal cases, and the extremity of one of these was enlarged into a globular form, the same as one of the two in the case of the normally developing egg. The polar cells finally become much reduced in size and are easily detached from the egg.

The segmentation is slightly meroblastic and a hollow blastula is soon formed; hatching occurs in about ten hours, when the apical cells and the two equatorial rings of velar cells have become ciliated. At the vegetative pole of the blastula four large, so-called, *endo-mesodermal* cells, forming part of the wall of the blastula, are elongated and prolonged into the blastocœl and two of them have their inner ends segmented off to form the primitive mesoderm; the other two and what remains of the two preceding ones give rise to the endoderm or intestine, while the decreasing area on the outside of the blastula embraced by the endo-mesodermal cells represents the blastopore. The primitive pair of mesoblastic cells are bilateral in position and render the larva bilaterally symmetrical. The blastoporic area gradually assumed a more ventral position and is then shoved forwards and inwards, finally disappearing at the bottom of a deep furrow which partially closes or concresces from behind forward, leaving the permanent mouth—stomodæum—at its anterior end, from which the œsophagus extends inwards toward the original site of the blastopore at the bottom of the stomodæal invagination. On either side of the posterior part of the stomodæal furrow there is a swelling; this pair of swellings eventually leads to the formation of the foot, on either side of which the otocysts are invaginated. At this stage also the shell gland is developed and the two primitive mesoblastic cells have segmented into a row of three cells each, lying symmetrically on either side of the median plane of the embryo. A glossophoral sac is formed in the floor of the œsophagus, and the anus is obviously broken through late.

The important points brought out in this paper are the following: (1) the possibility of artificially fertilizing the eggs of Gastropods; (2) the presence of a definite blastoporic area which is carried ventralwards and forwards leading to the formation of the mouth and œsophagus; (3) the presence of a pair of bilaterally disposed primitive mesoblast cells, derived from two of the endo-mesodermal cells, and the subsequent development from the former of a pair of mesoblastic cords on either side of the median line; (4) the partial concrescence and closure from behind forwards of the ventral furrow in which the blastopore is situated.

The oldest embryo figured is one of 130 hours. The figures are excellent, and the paper as whole bears evidence of having been prepared with great care, and represents an important contribution to molluscan embryology.

2. The Development of Dentalium.[1]—M. Kowalevsky concludes that the development of Dentalium has a good deal in common with that of the Lamellibranchs, the segmentation resembling that of Unio as described by Rabl, and Teredo as described by Hatschek. The segmentation is nearly regular, and leads to the formation of a hollow blastula and an invaginate gastrula. The mesoderm is derived from the inner wall of the invaginated side of the blastula, and the mesodermic cells are disposed symmetrically on either side of the median line. The shell-gland becomes defined very early on the dorsal aspect of the embryo, and as the blastopore travels forward, as in Patella, the area of the shell-gland, or mantle-organ, becomes greater, so that it gradually embraces the body of the embryo, especially over the region just behind the foot, leading to the development of the characteristic tubular shell. The resemblance of the larvæ of Dentalium to those of the Annelids is shown to be only a very superficial one. Three ciliary girdles encircle the anterior or cephalic pole of the larval body. The blastopore is wide at first, and persists as such much longer than in Patella; it is also elongated in the process of shifting towards the ventral, anterior aspect. A radular sac is developed on the inferior side of the œsophagus. The cephalic ganglia develop from a pair of deep invaginations of the ectoderm of the velum; the pedal ganglia from a pair of proliferations of cells from the ectoderm of the foot. The otocysts are developed before the pedal ganglia on either side of the foot and much in the same way as in Patella.

This memoir, illustrated with eight well-executed plates, the figures being drawn from actual sections, is a very important contribution to molluscan morphology, as nothing of equal value has appeared since the publication of the paper on Dentalium by H. Lacaze-Duthiers in 1857.

3. The Development of the Chitonidæ or Polyplacophora.[2]—This important paper by M. Kowalevsky discusses very fully the development of *Chiton polii*, valuable observations being also recorded upon *Ch. olivaceus* Spengler, and *Acanthochites discrepans* Brown. The ♀ carries about a mass of eggs in the mantle cavity, between the gills and mantle; those set free by the ♀ do not develop normally. The ova are enclosed by a chitinous covering, consisting of hexagonal plates which support processes externally, which vary in form in the various species.

The four first segmentation spheres are nearly equal; each of these subdivide into two, giving rise to four upper and four lower ones. The polar globules rest near the center of the area

[1]Etude sur l'Embryogenie du Dentale, memoire VII, par M. A. Kowalevsky, Ann. du Mus. d'Hist. Nat. de Marseille, Zool. Tom. I, Seconde partie, 1882–1883.

[2]Embryogenie du *Chiton polii* (Philippi) avec quelques remarques sur le Developpement des autres Chitons, memoire V, par M. A. Kowalevsky, Ann. Mus. d'Hist. Nat. de Marseille, Zool., Tom. I, second partie, 1883. 4to, pp. 46, pls. VIII.

embraced by the four upper, smaller cells of the animal pole. By division of the lower cells there arises a third layer of four intermediate cells, and soon after these four others appear which are apparently derived from the four upper ones. Thereupon six more smaller cells are developed at the animal pole, and somewhat later eight more such appear at the vegetative pole, so that the embryo is now composed of thirty-six cells. At this stage the gastrula mouth begins to develop; at first, as a slight depression, which later becomes deeper, leading to the formation of a symmetrical gastrula consisting of ecto- and endoderm. The two annuli or cycles of large cells, which represent the velum, are now differentiated.

The gastrula is next somewhat elongated, and near the blastopore an endodermal cell is pushed into the blastocœl to give rise to the mesoderm. The blastopore is soon displaced somewhat ventralwards, and simultaneously certain ectodermal cells are drawn inwards to form part of the wall of the cavity of the gastrula. There are two distinct, symmetrically disposed groups of mesodermal cells near the blastopore; the largest of these cells still form part of the endoderm and take part in limiting the cavity of the gastrula. The blastopore is gradually shoved nearer to the velum, and in connection with it is developed an œsophagus formed of ectodermal cells. The mesodermal cells have multiplied, but retained their bilaterally symmetrical position.

The œsophagus is now a spacious sac, from the posterior, inferior wall of which a radular sac has been invaginated. Immediately behind the mouth, in a median line, there is developed an invagination, which Kowalevsky calls the pedal gland. Two longitudinal, anteriorly conjoined thickenings of the ectoderm, which encroach upon the mesoderm, form the rudiments of the pedal and branchial nerves. The four nerve cords are gradually split off from the ectoderm and assume their definitive position in the mesoderm. The cavity in the pedal gland becomes filled with a slimy secretion. At the apex of the velar area a pair of ectodermal cells support a tuft of cilia. At certain points, where spiculæ appear later, each spicule-forming ectodermal cell acquires a clear vacuole. There now appear seven transverse furrows on the dorsal aspect, in each of which the cuticula, which now covers the back, becomes thickened. The ventral aspect is now mostly embraced by the foot, which consists of a layer of deep columnar ciliated cells. Anteriorly the cephalic ganglion is developed as a cellular body, enclosing a hollow cavity, and posteriorly the branchial ganglion appears as the widened ends of the two branchial nerves, lying close to the ectoderm. The posterior section of the gut is surrounded by a dense mass of mesodermal cells, which doubtless furnish the materials for the development of the segmental organs, vessels and sexual organs. At a somewhat later stage fibrils from multipolar cells are developed in the cephalic ganglion. In the anterior part of the body, the mesodermal cells form a gelatinous connective tissue between the organs. The pedal gland is now very strongly developed; its secretion is poured out between the ectodermal cells, a special opening for it being absent. At the sides of the body, above the foot, a ciliated band is present, which marks the site where the branchiæ will appear. At the level of the first dorsal fold, the eyes may be recognized. The larva now leaves the egg envelope and swims about by means of its velum. The calcareous spicules are still enclosed by their mother cells, but soon break through. After the lapse of several hours to several days, the larvæ finally rest on the bottom, losing the velum, which is replaced by other ectodermal cells. A diverticulum of the intestine at this time probably represents the liver. An invagination at the posterior end of the body seems to be the rudiment of the rectum. The pedal gland seems to have become smaller than in the preceding stage; in young Chitons (probably a year old) it is still present, but in those somewhat larger it is absent; it is, therefore, an organ pertaining to the embryonic period. The cuticular thickenings which lie in the transverse dorsal furrows are the rudiments of the segmented shell, and in each furrow, beginning at its anterior border, small calcareous plates are formed. The eyes are heaps of pigment in the ectoderm, with a clear nucleus in the center, lying close to the branchial nerves. In a fully developed young Chiton they were sunken into the skin and the ectoderm became circumscribed somewhat in the form of a cornea. The eight segments of the shell appear sometime after the metamorphosis in *Ch. polii* and *cinereus*, but in *olivaceus* somewhat before it.

4. THE DEVELOPMENT OF THE GILL IN FASCIOLARIA.[1]—Dr. Osborn's observations show that the gill of this gastropod is developed from a ridge of the ectoderm formed in the median line between the border of the advancing mantle and the velum. Later, with the growth and folding forward of the mantle and the formation of a mantle cavity, the gill is also carried forward and is brought to occupy a position on the outer instead of the inner wall of the branchial chamber. This change of position, the author finds, is entirely due to the manner in which the mantle cavity is developed. The species investigated by Dr. Osborn was *F. tulipa* Linn., var. *distans* Lam.

[1] H. Leslie Osborn. Studies from Biolog. Lab., Johns Hopkins University, III, No. 5, pp. 217–225, pl. XIII, 1885.

PSYCHOLOGY.

Intelligence of the Hen and Opossum.—Advices from home inform me that an early brood of chickens with the mother hen were taken into the cellar to protect them from the very cold weather which prevailed. Here they did well and appeared contented till a thaw and flood occurred. When the cellar was visited the next morning, several inches of water were found in it, flooding the quarters occupied by the brood. The hen was standing deep in the water with all of the chicks perched on her back. She was standing on the highest object to which she could step. She could have flown to higher objects, but this would have dislodged the youngsters and resulted in their being drowned.

This reminds me of an incident which I reported to the Naturalist many years ago, which may be briefly repeated. A boatman on the Illinois and Michigan canal observed an object on a fence-post, surrounded by water, which enabled him to work his boat up to it. There he found an opossum with several young ones in the pouch or pocket with which nature has provided this animal in which to carry her young. She was nearly famished and suffered herself to be taken on board without the least opposition and ate ravenously of the food given her. They were taken to Chicago and presented to my brother, in whose possession I saw them after the young ones had attained the size of small rats. They made rather pretty pets.

In both of these instances there seems to have been more of reason than of instinct, if by the latter we mean that inherited faculty which long-repeated emergencies has taught a long ancestral line a mode of avoiding or escaping danger.—*J. D. Caton.*

The Swallow as a Surgeon.—Dr. Walter F. Morgan, of Leavenworth, Kan., sends to the *Medical Record* this curious account of what may be called aviarian surgery, related to him in 1876 by the late Joseph O'Brien, Esq., of Cleveland, O.: "On going into his barn Mr. O'Brien discovered a swallow's nest, and being a natural observer and lover of animals, he climbed to the nest and found in it two young swallows, one being smaller and less vigorous than the other and having a slighter covering of feathers. Upon taking the young bird in his hand, he was astonished to find one of its legs very thoroughly bandaged with *horse-hairs.* Having carefully removed the hairs one by one, he was still more astonished to find that the nestling's leg was broken. Mr. O'Brien carefully replaced the bird in its nest and resolved to await further developments. Upon visiting the 'patient' the next day the leg was again found bandaged as before. The bird-surgeon was not again interfered with, and the case being kept under observation, in about two weeks it was found that the hairs were being cautiously removed, only a few each day; and finally when all were taken off the callus was distinctly felt, and the union of bone evidently perfect, as the bird was able to fly off with its mates. Such instances may seem incredible to those not yet prepared to fully accept the axiom of the scientists, viz., 'That the intelligence of animals differs from that of man only in degree and not in kind.'"

ANTHROPOLOGY.[1]

COREA.—The United States National Museum has just received from Ensign J. B. Bernadou, U.S.N., a large and intelligently selected collection of ethnological objects from Corea. Among them are several illustrated books full of water-color sketches of Corean life. Almost the same day, Messrs. Ticknor & Co. sent us Mr. Percival Lowell's work entitled, "Chosōn, the land of the Morning Calm, a sketch of Corea." We rarely have the opportunity of testing a book of travels, in an out-of-the-way region, by the touchstone of things. It has been for that reason a source of great pleasure to us to read Mr. Lowell's book, in the light of Ensign Bernadou's specimens. Perhaps the air of the philosopher, which the author here and there assumes, may to some readers appear the more attractive part. But to us, we must admit, the chief charm lies in the assurance, growing on us from page to page, that the writer is telling the truth. The journey to Sōul from Chemulpo in a sedan-chair, and the khan heated with brush, are verities. We have seen pictures of these things painted by Coreans themselves, and they look like Mr. Lowell's descriptions. The walls, gateways, detached houses, endless series of courtyards, tile roofs, grinning monsters on the house tops, are well-drawn word pictures of things that have existence. Then the baggy clothing, pantaloons that measure just seventy-two inches in the waistband, great flowing surplices, shoes of straw, hāts in endless variety, the sack-cloth of the mourner, these are portrayed so faithfully that we have only to transfer Mr. Lowell's language to the label. The three chapters, *impersonality*, *patriarchy* and the *position of woman*, are well and clearly worded expressions of convictions after a brief stay and superficial examination. Americans who have spent many years in the far east have lost some predilections on these subjects after a wider experience.

The palaces of Corea are essentially Chinese. First the great courtyard where horsemen dismount, bulls of burden halt, and sedan-chairs discharge their living cargoes. Then the arched gateways and paragons of roofs, covering the entrance to a first inner court, where bearers of gifts and invited guests arrange charms to captivate royalty. The graded ways and platforms leading to a verandahed throne-room, where soldiers and citizens vie in the gorgeousness of their profuse attire and especially

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

in the diversity of their hats. Above all, the affected grandeur of royalty amid decay and national poverty, these are all subjects which Mr. Lowell fully appreciates and describes with charming grace.

As to the population, Mr. Lowell says: "Money being more important to the Corean official oligarchy than men, the amount of taxable property in the kingdom, represented principally by rice fields, is much more accurately known than is the number of its inhabitants. No census of the population is ever taken, the number of the houses alone being counted. The estimate formed recently by a Japanese paper is probably the nearest yet made to the truth. This estimate gives Corea 12,000,000 inhabitants.

"As for Sōul, the aggregate of population, including both the city proper—that is, the part within the wall—and the outlying suburbs, will probably not exceed in all 250,000 souls. The amount of ground covered is about ten square miles. But a city in the far east extends only in two dimensions, not, as with us, in three. Tokio, in Japan, with about 1,200,000 inhabitants, covers eighty square miles.

"The fabulously large estimated populations of Chinese cities—as for instance, Canton—will, I think, on trustworthy census be found to have been greatly exaggerated."

THE RELATION OF ANTHROPOLOGY TO THE SCIENCE OF MIND.—In the scheme of anthropology followed by the NATURALIST, the science of mind follows hard upon comparative physiology. In this journal, as it would be in an academy or scientific association, the rule has been to allow only those psychical inquiries to enter in which natural history methods and processes, well approved, have been engaged. It is with profound pleasure, therefore, that we draw attention to Dr. Alexander Bain's paper, read at the last meeting of the British Association, upon the scope of anthropology and its relation to the science of mind. Says this distinguished authority: "The mode of research, grounded on discriminative sensibility, and working up from that, according to the best known principles of our intellectual nature, may be contrasted with another mode which has always been in vogue, namely, finding out and noting any surprising feats that animals can perform, out of all proportion to what we should be led to expect of them. The spirit of such inquiries is rather to defy explanation than to promote it; they delight to nonplus and puzzle the scientific investigator, who is working his way upward by slow steps to the higher mysteries. Before accounting for the exceptional gifts of animals—the geniuses of a tribe—we should be able to prove the average and recurring capabilities.

"It is an error to suppose that mental qualities do not admit of measurement. No doubt the higher complex feelings of the mind are incapable of being stated with numerical precision, yet, by a proper mode of approaching the subject, a very considerable degree of accuracy is attainable.

"As to the present position of the science of mind in the British Association, it is nowhere. Taken in snatches, it appears in several places; it would come in under zoölogy, which embraces all that relates to animals; under physiology, in connection with the nervous system and the senses; and it figures still more largely, although in an altogether subordinate and scarcely acknowledged fashion, in the section on anthropology. Indeed, to exclude it from this section would be impossible; man is nothing without his mind.

"Now, while zoölogy and physiology would keep the study of mind within narrow limits, there is no such narrowness in the present section. In the ample bosom of anthropology, any really valuable contribution to the science of mind should have a natural place.

"Psychology has now a very large area of neutral [non-controversial] information; it possesses materials gathered by the same methods of rigorous observation and induction that are followed in the other sciences. The researches of this section exemplify some of these. If these researches are persisted in, they will go still further into the heart of psychology as a science, and the true course will be to welcome all the new experiments for determining mental facts with precision, and to treat psychology as an acknowledged member of the section. To this subdivision would then be brought the researches into the brain and nerves that deal with mental functions; the experiments on the senses having reference to our sensations; the whole of the present mathematics of man, bodily and mental; the still more advanced inquiries relating to our intelligence; and the nature of emotion, as illustrated by expression, in the manner of Darwin's famous treatise. Indeed, if you were to admit such a paper as that contributed by Mr. Spencer to the Anthropological Institute, you would commit yourself to a much further raid on the ground of psychology than is implied in such an enumeration as the foregoing."—*J. Anthrop. Inst., xv, 380–388.*

JEWISH ABILITY.—Mr. Joseph Jacobs, who has been communicating to the Anthropological Institute papers upon the Jewish race, reproduces in the February number of the journal of that society his paper, read at the Aberdeen meeting of the British Association. Applying to Jews Mr. Galton's methods with reference to hereditary genius in England, he aims to find how many eminent men, of certain rank, exist in each million of Englishmen, Scotchmen and Jews.

It follows that the 722,000th is equal in ability to the 739,000th Scotchman and the 756,000th Englishman, reckoning from the bottom. Or, in other words, if we took a hundred men at hazard from each of the three races, the 72d Jew, reckoned from the least able, would equal in ability the 74th Scotchman or the 76th Englishman, and would be the superior to the 72d of either of the other two races. Thus we arrive at last at a real comparative estimate of Jewish ability, which we may state roughly in the following way: The average Jew has four per cent more ability than the average Englishman, and two per cent more than the average Scotchman.

The men of ability are arranged in grades, according to their eminence, over the space of a century. It is interesting to note even the names. In the first rank Mr. Jacobs places Benjamin Disraeli, Heinrich Heine, Ferdinand Lassalle and Felix Bartholdy-Mendelssohn. In the second class are Auerbach, Benfey, Börne, Cremieux, Gans, A. Geiger, Grætz, Halèvy, Sir W. Herschell, Jacobi, Jessel, Lasker, Maimon, Marx, Meyerbeer, Neander, Oppert, Palgrave, Rachel, Ricardo, Jules Simon, Steinthal and Lazarus, Sylvester, Steinschneider and Zunz.

The reasons assigned by Mr. Jacobs for Jewish ability in certain lines are doubtless correct, and furnish a confutation of the doctrine that only prosperity ministers to human progress.

The Mangue Language.—Dr. Brinton read before the American Philosophical Society, in November last, a paper on the Mangue, an extinct dialect formerly spoken in Nicaragua. The chief source of this paper was the MS. of Don Juan Eligio de la Rocha. The Mangue is the mother-tongue, from which the Chiapanec of Chiapas branched off. The Mangues at one time occupied the whole coast, from the entrance of the Gulf of Nicoya to Fonseca bay. Some time in the fourteenth century a large colony of Aztecs descended the coast and seized the strip between Lake Nicaragua and the Pacific, thus splitting the Mangues in two and driving a large part of them from their homes.

"Tableau des Bacabs" is the name given by Leon de Rosny to a certain double plate of the Cortesian Codex. By that name he intended to indicate that the table or plate refers to the four Bacabs, or gods, which were supposed to bear up the four corners of the earth—the gods of the cardinal points.

On this plate are the four characters supposed to be the symbols of the cardinal points. As these probably occupy on this plate their proper relative positions, we have here, perhaps, the best existing data by which to determine the respective points to which the symbols are assigned.

Entering upon the study of the plate with this object in view, I soon formed the opinion that the plate is, in fact, a calendar table. The discovery that the rows of day symbols, lines and dots in the outer form but a single continuous line and cover one cycle of thirteen months, or 260 days, convinces him of the correctness of this opinion. Applying this discovery to the plate 44 of the

Fejervary Codex, and bearing in mind that it was Mexican, it was readily shown to be a calendar formed upon the same plan as the "Tableau des Bacabs." His next step was to determine, if possible, the object of the singular arrangement of the days in the middle circle of the Cortesian plate and in the corners of the Fejervary plate. This he has shown clearly to have been in accordance with both a Maya and Mexican custom of dividing the twenty days of the month into four groups by placing them in the order they come, one alternating in each group. Each of these groups have a special relation to one of the four years of both calendar systems. The first part of my paper is devoted to the explanation and discussion of these points; the remaining portion to the proper assignment of the cardinal point symbols. In the course of this discussion, I enter at some length into the question of the assignment of the years, colors and elements.

Since the publication of this paper, it has been ascertained that some of the conclusions reached by me have been arrived at independently by one or two of the European students, whose papers on these codices will shortly be published. I am now satisfied that I am able to explain and illustrate the use and significance of nearly all the numerals in the Dresden and other Maya codices. By means of this discovery, the reality of which is demonstrable, most of the obliterated day symbols and numeral characters can be restored and errors in the reproductions detected. This discovery shows that these calendar systems are much simpler than they have been supposed to be.—*Cyrus Thomas.*

Aboriginal Baking Pans.—I wish to call the special attention of archæologist to a form of stone implement upon which additional light has been thrown. Lt. Ray, U.S.A., has just sent to the National Museum a collection of objects illustrating the aboriginal industries of the Hupa Indians of California. Among these are five stone implements, called baking pans, used in cooking bread made of acorn meal. They may be very properly termed "individual" pans, each of them holding enough meal to bake a good-sized corn-cake, with brown crust all around. They are made either of lapisollaris, or of a soft schist not subject to fire-cracks. The dimensions are as follows, although the outline is a very irregular oval:

77,160.—Length, 3½ inches; width, 2¼ inches; height, ¾ inch.
77,161.—Length, 3¾ inches; width, 3½ inches; height, 1½ inches.
77,162.—Length, 5 inches; width, 3¾ inches; height, 1½ inches.
77,163.—Length, 4¾ inches; width, 3¾ inches; height 2½ inches.
77,164.—Length, 6¾ inches; width, 5½ inches; height, 1¾ inches.

With the exception of 77,163, of schist, they are from ¾ to 1 inch thick. Comparing these with our archæological collections, I find many specimens of soft material labeled paint-cups, which are much more likely to have been individual baking pans.

War-Clubs vs. Digging-Sticks.—Toward the end of April the secretary of the Smithsonian Institution received from Dr. Stephen Bowers, of San Buenaventura, California, editor of the *Pacific Science Monthly*, No. 4, Vol. 1, of that publication, containing an account of the discovery of Indian relics in a cave in the San Martin mountains, Los Angeles county, California. Among the relics were four heavy perforated stone (probably serpentine) disks, measuring from four to five and a half inches in diameter, and still retaining their handles of *toyon* or bearberry-wood, which is among the hardest in Southern California. The handles are from thirteen to seventeen inches in length, and are cut off bluntly. To judge from an accompanying photograph, the stones are in every way analogous to a certain class among the many perforated stones collected by Mr. Paul Schumacher and others in the same neighborhood, and now in the archæological collection of the National Museum.

Dr. Rau expressed ten years ago (in "Archæological Collection of the U. S. National Museum," p. 31), the opinion that the more bulky of the Californian disk or cone-shaped stones served as club-heads, and he was strengthened in his view by the fact that the extensive National Museum collections from the above-named region contain no other heavy implements which could have been used for striking; but he could not then foresee that his theory would be so unexpectedly verified by the finding of such stones with their handles still inserted. Mr. Schumacher considered the stones as weights for digging-sticks, relying on the statement of a half-breed *vaquero*.

The Aztec Language is still the favorite language among linguistic students as well as among the scholarly authors of books on American ethnology. The harmonious, vocalic structure of its words as well as the copiousness of its literature may account for that, and we gratefully acknowledge every new effort to popularize the study of Aztec, whenever such efforts rest on a scientific basis. The director of the Mexican Statistical Bureau, Mr. Ant. Peñafiel, has made a new advance in that direction by republishing the "Arte Mexicana" of the Jesuit priest of Puebla, Antonio del Rincon (died 1601), who after a prolonged theoretic study of his own dialect, that of Tezcuco, published the above Aztec grammar in 1595. Antonio del Rincon was a descendant of the "kings" of Tezcuco, near Mexico, and as such had peculiar facilities of becoming acquainted with all the dialects of Anahuac, if not of the whole Nahuatl family. In the vocabulary appended, he differs in many points from Molina, and whether he then gives his native Tezcucan dialect forms or varying forms of the "literary" Aztec, is not always possible to find out. As an early source for dialectic study the "Arte Mexicana" will prove to be of peculiar value.—*A. S. Gatschet.*

MICROSCOPY.[1]

STRUCTURE OF THE HUMAN SKIN.—The following note refers to a method of isolating the epidermis of human and other embryos from the underlying dermis, and to the presence of a layer of cells, not previously described, which may be observed in the epidermis when so prepared, and which corresponds, I think, to the epitrichium of birds. The method is also convenient for the study of the development of hairs.

It is well known to physicians that if the fœtus dies and is retained, it is preserved for a considerable period without disintegration of the tissues in the amniotic fluid. In specimens thus preserved it is often found that the epidermis is loosened so much that strips can be removed without tearing off the underlying tissues. Now as the amniotic fluid is little more than a salt solution, the facts just stated naturally suggest that a salt solution preserved from septic changes is sufficient to loosen the epidermis of the embryo. My experiments have satisfied me that a sojourn of several days in a 0.6 per cent solution of common salt, with 0.1 per cent thymol added to prevent putrefaction, is a simple and satisfactory way of liberating the embryonic epidermis from its connections, so that bits can be easily removed for histological examination, for which they are apparently still adapted; even the minute structure of the nucleus will persist through this treatment, though imperfectly.

A piece of epidermis of a human embryo, of about six months, taken from the scalp by this method and stained with hæmatoxyline, is shown in the accompanying figure;[2] each dot represents a nucleus. We distinguish two kinds of nuclei, those which are darker stained and those which are lighter. Some of the nuclei in the figure appear darker from another cause to be stated directly, but with the exception of these, all the dark nuclei belong to cells which participate in the formation of the hairs. At first the dark nuclei make a little cluster, as at *1* and *2*; the clusters grow in size; one a litttle larger is seen just to the left of that numbered *2*, one a good deal larger is shown at *3*. Sections show that such clusters are on the under side of the epidermis and form slight protuberances or rudimentary papillæ; the papillæ lengthen out and acquire rounded ends, *4*; they grow rapidly down into the cutis, and by the contraction of their upper part become club-shaped, *5* and *6*. The next step is the formation of the dermal papillæ of the hair, *7*; a little notch arises at the thick end of the epidermal ingrowth, and the tissue filling this notch is the so-called dermal papilla. The figure presents also a well-developed hair; here the axial portion of the papilla has formed the hair, *h*, while the cortical portion has formed the follicle, *f*; the end of the

[1] Edited by Dr. C. O. WHITMAN, Mus. Comparative Zoölogy, Cambridge, Mass.

[2] The illustrations are borrowed from a forthcoming work on human embryology.

hair is thickened, *h'*, as the so-called hair bulb; the sebaceous gland, *Gl*, has begun to grow out from the follicular walls. In the upper part of the follicle the hair lies quite free, hence in several places where the hairs have been forcibly torn off the upper part of the follicle, *F*, still remains, while the lower part attached

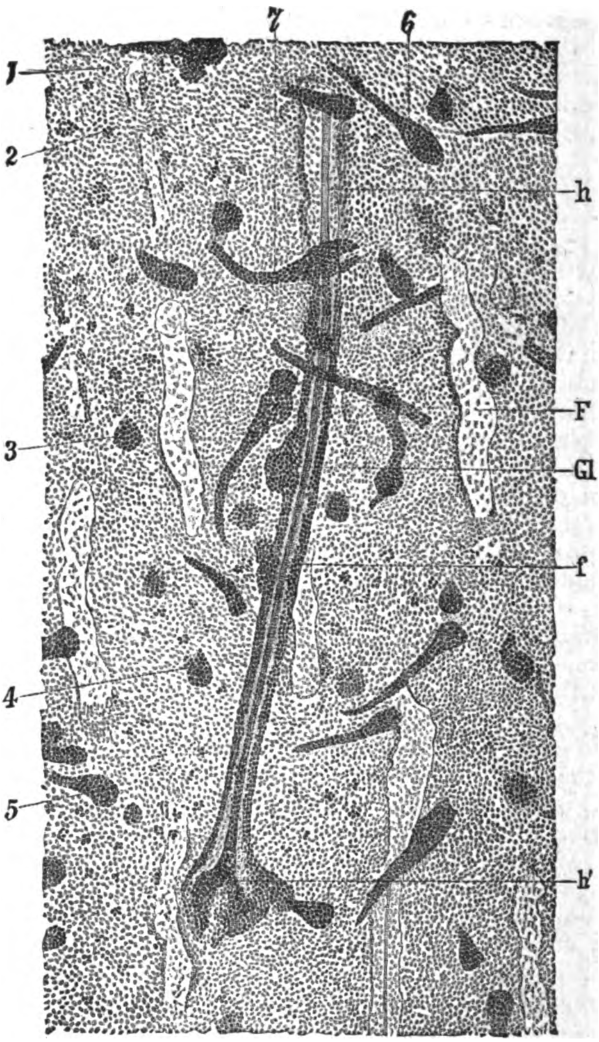


FIG. 1.—Embryo human epidermis.

to the hair is gone. In the walls of the follicle I notice granules which I take to be of eleidine (cf. Ranvier's Traité technique, p. 890).

The above description contains nothing new, and is intended to serve merely as an explanation of the preparation regarded as an object to demonstrate the development of hairs. The preparation also reveals the existence of an important undescribed layer in the skin, namely, the epitrichium.

With a low power one observes in the preparation we have been considering, and in others similar to it, that there are scattered about everywhere little groups of nuclei, three to five, as *r* in Fig. 1, which appear darker than the rest; only a very few of these are represented in the drawing; examination with a higher power shows that this effect is produced by large stained bodies lying on the outer surface of the skin.

The characters of the bodies in question are indicated by the accompanying figure. They are irregular in size and shape; quite granular; in preparations stained in picric-acid carmine each body is readily seen to lie in a separate area with very distinct polygonal outlines, but the area is only partly filled by the body; occasionally there is a distinct round body of smaller size and more darkly stained than the main body we are now describing. I consider the outlines to be cellular, the granular bodies to be the shrunken mass of protoplasm of the cells, and the inner round body to be the nucleus. In fact, the supposed nuclei appear very clearly in almost every one of the cells after a specimen has been stained by alum hæmatoxyline. The cells are very much larger than those of the horny layer proper, two layers of which are drawn in, in the figure, to scale for comparison. The layer of cells is continuous over the whole surface, even over the hair follicles and the hairs, and is absolutely distinct from the horny layer. It can hardly be questioned that it is homologous with the so-called epitrichium of birds and reptiles. For a full account of the epitrichium of those animals, I refer to the valuable memoir by E. G. Gardiner in the Archiv. für mikroskopische Anatomie, Vol. XXIV, p. 289. Welcker long ago (1864) showed that an epitrichium, or a special layer outside of the horny layer, exists in various mammals, but Kölliker has expressly denied the occurrence of a true epitrichium in man, and after saying in his larger Entwickelungsgeschichte (2d ed., p. 776) that the outer parts of the horny layer may be thrown off, adds, " it has not been demonstrated, that over all and

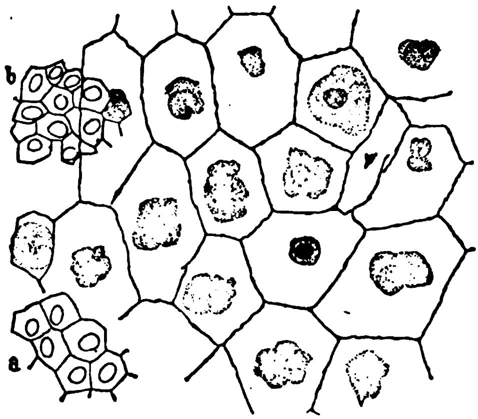


FIG. 2.—Human epitrichium.

in the first instance only the external layer is sloughed off, and that between this and the next following horny layers there is a definite contrast." As we have seen, the distinguished Würzburg embryologist has expressed doubts not justified by the facts, there being an external layer which is extremely different from the horny layer, and is apparently a true epitrichium.

The human epitrichium, so far as I have observed, is developed quite late, about the fourth or fifth month, though to be sure an enlargement of the outermost epidermal cells may be observed earlier than this.

I deem it probable that the presence of the epitrichium as an intact membrane results in the retention of the secretions of the fœtal sebaceous glands, and is therefore the immediate cause of that hitherto unexplained phenomenon, the formation of the so-called *vernix caseosa* of physicians.

It is not rare in science that something, easily seen, remains long overlooked, and each time we are touched by surprise when observation is thus corrected. Certainly the human skin is not a structure which the microscopist would have searched in order to discover a new layer of cells, which are easily demonstrated and very conspicuous. I may confess that I looked at the preparations, which show the epitrichium plainly, a great many times without observing at all what I now see at the first glance.—*Charles Sedgwick Minot.*

KARYOKINESIS.—In the study of karyokinesis in the arthropods, Professor J. B. Carnoy[1] obtained the best results with the two following mixtures:

(1)[2]	Chromic acid (2 p. c. or more)	45 parts.
	Osmic acid (2 p. c.)	16 "
	Glacial acetic acid	3 "
(2)	Corrosive sublimate	
	Glacial acetic acid (1 p. c.).	

The object (testes) is left from six to ten minutes in one of these mixtures; then washed in distilled waters and further hardened in alcohol.

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SCIENTIFIC NEWS.

—Edward Tuckerman, professor of botany in Amherst College, died March 15, aged sixty-nine years. He was a graduate of Union College (1837), of Harvard College (1846), of the Harvard Law School (1839); studied history, philosophy and botany several years in Germany, and in 1858 was appointed to the chair of botany at Amherst College, which he held to the day of

[1] La Cytodiérèse chez les Arthropodes, p. 211. (Extrait de la Revue "La Cellule," I, 2o fas., Louvain, 1885.)
[2] Modified form of Flemming's mixture.

his death. Distinguished as a lichenologist, Tuckerman was one of our most philosophical botanists, and a ripe scholar, with literary skill of a high order, belonging to a family well known for its literary and musical tastes. Professor Tuckerman was a pioneer in the study of the White Mountain flora. His name as an explorer will be ever remembered in the ravine of Mt. Washington, which bears his name. Among his principal works are the following: "An enumeration of North American Lichenes," 1845; "A synopsis of the Lichenes of New England, the other Northern States and British America," 1848; "Genera Lichenum: an arrangement of the North American Lichens," 1872; "A synopsis of the North American Lichens," part I, 1882. He also contributed the chapter on lichenes to the botany of Wilkes' U. S. Exploring Expedition, and was the author of a number of other papers and works.

—The annual report of the trustees of the American Museum of Natural History in Central Park, New York, for 1885–86, shows gratifying progress in the scientific development of that institution. The expenditures for maintenance were $30,508.80, while $6,654.16 were spent for improvements and additions to the collections; $50,937.50, a gift of Mr. W. H. Vanderbilt, being carried to the endowment fund. The purchases include the Bailey collection of birds' nest and eggs, toward the purchase of which Mrs. Robert L. Stewart contributed $1500.

—The celebration of the sixty-ninth year of the New York Academy of Sciences took place on the evening of May 10th, at Columbia College. Secretary H. L. Fairchild read an interesting *résumé* of the society's history. Dr. Asa Gray read his first paper before this society. Its first president was the Hon. Samuel L. Mitchell, who held the office seven years. He was succeeded by Dr. John Torrey, Major Joseph Delafield, Professor Charles A. Joy and Dr. John S. Newberry. The history of the society will form the subject of a forthcoming volume.

—From the report of the Zoölogical Society of Philadelphia it appears that, as the result of special effort, $22,000 were raised for the present and future support of the garden. Still a large endowment fund is needed to render the garden permanent. The most remarkable addition was a pair of hairy-nosed wombats from Australia. A notable addition is three hybrids between a female *Canis latrans* and a male dog, said to be a Scotch colley.

—An interesting feature of recent numbers of the Journal of the Royal Microscopical Society has been the publication of portraits from photographs of all the presidents of the society. The April number furnishes a full-page likeness of the present president, Rev. W. H. Dallinger.

—Mr. Alfred R. Wallace, the distinguished English naturalist, is to give a course of eight lectures at the Lowell Institute, Boston, Mass., beginning in November next.

—Mr. C. W. Peach, so well known as a zealous field naturalist and collector of fossils, whose name appeared so often in Gosse's sea-side books, died in March.

—Dr. T. Spencer Cobbold, well known for his work on parasitic worms, died in London in March, aged fifty-seven.

—The eminent botanist of Liegé, Professor C. J. E. Morren, died late in February at the age of fifty-three years.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

National Academy of Sciences.—In addition to the list of papers read at the Washington meeting the following were presented April 21st and 22d:

On color contrast. By Ogden N. Rood.

Classification of the Cambrian system of North America (by invitation). By Chas. D. Walcott.

Crystallization of platinum by means of the electric discharge in vacuo. By A. W. Wright.

The Stomatopoda of the "Challenger" collection. By W. K. Brooks.

Budding in the Tunicata. By W. K. Brooks.

Effect of magnetization on the electrical resistance of metals. By A. W. Wright.

On a proposed expedition into the interior of Greenland during the present summer with Disco as a base (by invitation). By R. E. Peary, U. S. N.

At an evening meeting of the academy the Henry Draper medal was for the first time awarded to Professor S. P. Langley for his researches on solar physics. The Watson medal, with an honorarium of one hundred dollars, was given to Dr. B. A. Gould as a recognition of his services to astronomy in founding and conducting the Cordova observatory. At the same meeting a biographical notice of the late Professor Arnold Guyot, prepared by Professor J. D. Dana, was presented, and a similar notice of the late Professor John W. Draper was read by Professor Barker.

Biological Society of Washington, March 6.—Communications: Dr. George Vasey, New and recent species of North American grasses; Mr. Charles Hallock, Hyper-instinct of animals; Dr. W. S. Barnard, Exhibition of a fungus, with remarks; Dr. H. G. Beyer, U. S. N., Remarks on antipyretics.

March 20.—Communications: Dr. D. E. Salmon and Dr. Th. Smith, Notes on some biological analyses of Potomac drinking-water; Dr. H. G. Beyer, U. S. N., Remarks on antipyretics; Dr. W. S. Barnard, Exhibition of a fungus, with remarks; Mr. F. H.

Knowlton, Additions to and changes in the Flora Columbiana for 1885.

April 3.—Communications: Dr. Frank Baker and Mr. J. L. Wortman, Recent investigations into the mechanism of the elbow-joint; Mr. J. B. Smith, Some peculiar secondary sexual characters in the Deltoids, and their supposed function; Dr. C. Hart Merriam, Contributions to North American mammalogy—III. Description of a new sub-species of a gray squirrel; Dr. R. W. Shufeldt, U. S. A., Some early and as yet unpublished drawings of Audubon.

April 17.—Communications: Dr. Theo. Gill, The characteristics and families of iniomous fishes; Mr. F. A. Lucas, Notes on the vertebræ of Amphiuma, Siren and Menopoma; Mr. Frederick True, 1. Exhibition of a wood hare with abnormal growth of fur; 2. Some distinctive cranial characters of the Canadian lynx; Mr. John B. Smith, Ants' nests and their inhabitants.

May 1.—Communications: Dr. R. E. C. Stearns, Instances of the effect of musical sounds on animals; Dr. John A. Ryder, The evolution of the mammalian placenta; Dr. T. H. Bean, The trout of North America, with exhibition of specimens; Mr. W. H. Dall, 1. On the attachment of Lingula, with exhibition of specimens; 2. On the divisions of the genus Pecten.

New York Academy of Sciences, March 15, 1886.—Recent progress in chemistry, by Dr. H. Carrington Bolton, of Trinity College, Hartford, Conn.

March 22.—Significance of flora to the Iroquois (with grammatical notes), by Mrs. Erminnie A. Smith.

March 29.—Theories concerning the protective influence of mitigated virus, by Mr. Lucius Pitkin..

April 5.—Geological notes in Western Virginia, North Carolina and Eastern Tennessee (illustrated with specimens), by Dr. N. L. Britton.

April 19.—Mineralogical notes (*a*, On the hardness of a Brazilian diamond; *b*, A fifth mass of meteoric iron from Augusta county, Va.; *c*, Asteriation in garnet), by Mr. Geo. F. Kunz; Minerals of Staten Island, by Mr. B. B. Chamberlin.

April 26.—On the variation of decomposition in iron pyrites, its cause, and its relation to density, by Dr. Alexis A. Julien.

May 3.—Review of the fossil fishes of North America, with notice of some new species, illustrated with specimens and lantern views, by Dr. J. S. Newberry.

Boston Society of Natural History, March 17, 1886.—Dr. C. C. Abbot described the habits of the white-footed mouse; Professor Wm. Trelease read a paper on the North American species of Thalictrum (meadow rue); Professor W. T. Sedgwick exhibited some new and simple forms of apparatus in use in the biological laboratory of the Massachusetts Institute of Technology.

April 7.—Dr. R. R. Andrews read a paper on the development of the teeth (illustrated by the stereopticon); Dr. S. Kneeland showed some metallic tubes from a girdle found on an Indian skeleton at Fall river—the so-called "Skeleton in Armor;" and Mr. S. H. Scudder spoke of the mode of life of an ancient beetle.

April 21.—Mr. Percival Lowell read a paper on the Corean language; and Professor A. Hyatt showed and explained Hatscheck's models of the development of a vertebrate (Amphioxus).

May 5.—The annual meeting was held on this date. Business: Annual reports of the curator, secretary, and treasurer, on the condition and work of the society; report of the committee on the Walker prize for 1886; election of officers for 1886–7. Communication: Dr. G. L. Goodale read a paper upon plasmolysis.

Appalachian Mountain Club, March 10, 1886.—Mr. J. Rayner Edmands read a paper entitled "A day on Flume mountain and a night in the wilderness;" Mr. S. H. Scudder made some remarks on the progress of the State topographical survey; Mr. Rosewell B. Lawrence exhibited a new map of Middlesex Fells, intended to show wood-roads and foot-paths. The following subject was presented for discussion: What should be done by or for persons detained (possibly lost or injured) among woods and mountains?

March 23.—Mr. S. H. Scudder occupied the evening with an account of his three months' adventures by stage, canoe and ox-cart with an eclipse party in the Winnepeg and Saskatchewan country a quarter of a century ago.

April 14.—A paper by Professor A. S. Packard, entitled "Over the Mexican plateau on a diligence," was read by Mr. F. W. Freeborn; Professor E. C. Pickering presented for discussion plans for a summer school in geodesy and topography.

April 20.—A semi-social meeting was held from 7.30 to 10.30. During the evening Rev. John Worcester showed fifty lantern views of scenery on the Great Range.

July, 1886. Vol. XX, No. 7.

The American Naturalist.

DEVOTED TO THE NATURAL SCIENCES IN THEIR WIDEST SENSE.

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PECULIARITIES IN THE MANUFACTURE OF JENSEN'S CRYSTAL PEPSIN:

NATURE OF THE IMITATIONS, ETC.

THE champion pepsin of the world! The only pepsin found worthy to be imitated! Even the wealthiest manufacturing chemists could not resist the temptation!

One party used glue as a cheapening adulterant for the production of scale pepsin; another party has now succeeded in flooding the market with their imitations of my scale pepsin, owing to its extreme cheapness. This party now declares (not to the profession) that they use sixty pounds of dry egg albumen, peptonized by two hundred hogs' stomachs. A third party wrap their imitations in an exact *fac simile* of my circular, making full use of all my testimonials. The great injury these imitations cause my preparations can easily be understood.

The protection chiefly relied upon is through the profession's vigilance in discriminating between the genuine and the spurious article. When prescribing my pepsin, most physicians now underline my name thus, JENSEN'S Crystal Pepsin, and no misconception can excuse substitutions. The great reputation of this pepsin lies in that it is a peptone pepsin, *i. e.*, the texture of the stomachs in which the ferment is lodged is entirely dissolved, thereby obtaining all the pepsin. When thereto is added my recent improvement in precipitating from this solution all of the earthy and saline matter, leaving only the azotized constituent, containing all of the peptic principle, and, finally, is further concentrated by drying it upon glass plates until brittle scales are formed, the reason for its high digestive power can easily be understood. Why it surpasses also in keeping qualities all of the former pepsins, is owing to its scaly and brittle texture, it being the only organic medicine in the materia medica produced for the market in scales.

It is also perfectly soluble upon the tongue, pleasant to the taste, and practically inodorous.

Although it commands a higher price than any other pepsin in the market, it is, nevertheless, the most prescribed. Its purity and solubility, combined with its great digestive power upon albuminoids, have inspired physicians of a suggestive mind to try it also as a solvent for diphtheritic membranes and coagulated blood in the bladder. The success also of these novel uses has already become generally known to the profession all over the world. Physicians writing for samples will receive prompt returns.

Dr. Hollman (*Nederl. Weekbl.*, 18, p. 272) reports the case of an old man, aged 80 years, suffering from retention of urine, in whom the introduction of a catheter failed to produce the desired result. It was found that the bladder contained coagulated albuminoid masses mixed with blood. A few hours after the injection of about 16 grains of Dr. Jensen's Pepsin dissolved in water, a large amount of a dark, viscid, fetid fluid readily escaped by the catheter.—*London Medical Record.*

Dr. Edwin Rosenthal, acting on the suggestion of Dr. L. Wolff, has used an acidulated concentrated solution of pepsin as an application to the membranes of diphtheritic patients, for which there seemed to be no other help than tracheotomy, and reports that it acted like a charm, dissolving the membranes, admitting a free aëration of the blood, and placing them soon on the road to convalescence. The solution he used was:

℞.	Jensen's Pepsin,	ʒj.
	Acidi Hydrochloric, C. P.,	gtt. xx.
	Aquæ q. s. ft.,	fl. ℥j.

M. S.—Apply copiously every hour with a throat-mop.—*From the Medical Bulletin.*

Formula for Wine of Pepsin:

℞.	Carl Jensen's Pepsin,	gr. 192.
	Sherry or port wine,	℥ viss.
	Glycerin puris,	℥ iss.
	Acid Tartaric,	gr. v.

Sig. fʒj. after meals. This is three grains of the pepsin in each teaspoonful.

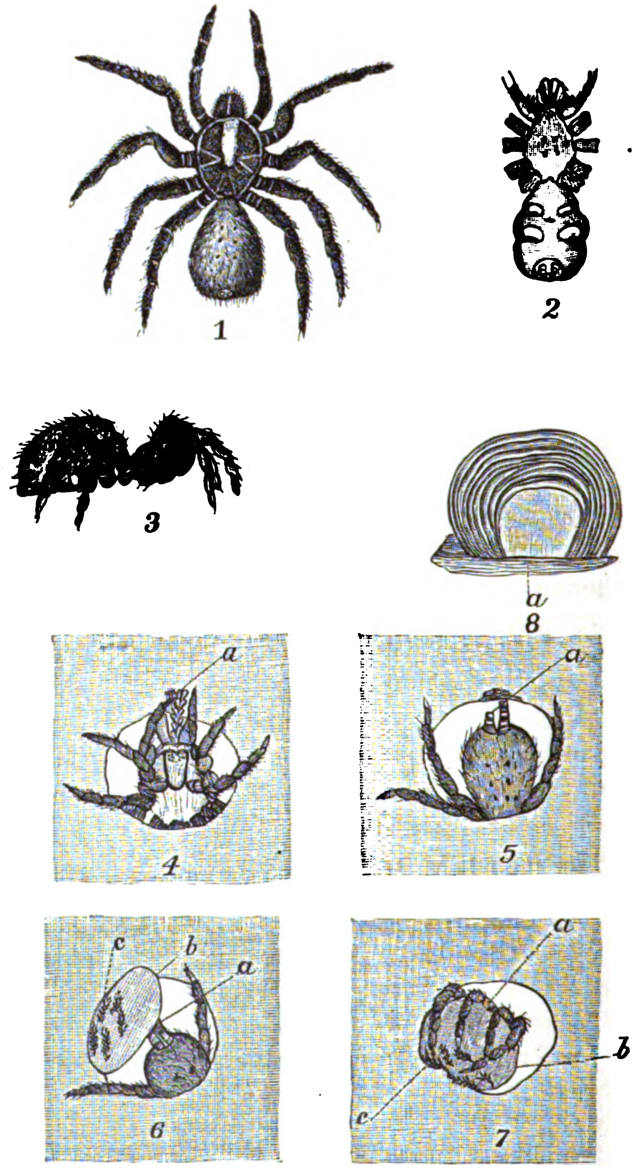
For severe attacks of colic it has afforded present relief, after a few doses have been given in short intervals, when other remedies have failed.

CARL L. JENSEN,

HOME OFFICE, 2039 GREEN STREET,

PHILADELPHIA.

PLATE XXIII.



G.F. Atkinson del.

A new Trap-door Spider.

THE

AMERICAN NATURALIST.

VOL. XX.—*JULY*, 1886.—No. 7.

A NEW TRAP-DOOR SPIDER.

BY PROF. GEO. F. ATKINSON.

IN his excellent work on trap-door spiders Mr. Moggridge says: "There would doubtless be a just feeling of pride and satisfaction in the heart of a naturalist, who could say that he had made himself thoroughly acquainted with all the species of a particular group of animals, had learned their most secret habits, and mastered their several relations to the objects, animate and inanimate, which surrounded them. But perhaps a still keener pleasure is enjoyed by one who carries about with him some problem of the kind but partially solved; and who, holding in his hand the clue which shall guide him onwards, sees in each new place that he visits fresh opportunities of discovery. The latter is certainly the condition of those who take an interest in searching out the habits and character of the trap-door spider."[1]

While many interesting facts in the life-history and architecture of trap-door spiders were observed and collated by Mr. Moggridge, he very modestly says that many remain yet to be gathered in; that we are only on the threshold of discoveries of these creatures, who have lain quietly in the earth century after century, and that he will be satisfied to have been able to "hold the door sufficiently ajar to permit those who love nature and her ways to catch a glimpse of the wonders and beauties of the untrodden land that lies beyond."[2]

A favorable circumstance afforded me an opportunity for making some observations on the unseen "wonders and beauties

[1] Harvesting Ants and Trap-door Spiders, Supplement, p. 180.
[2] Harvesting Ants and Trap-door Spiders, p. 136.

of the untrodden land" which is the abode of these interesting creatures, and it is with a sense of pleasure that I note them.

Some time in the latter part of May or early part of June, 1885, Mr. Merritt, of Pittsborough, N. C., brought to Chapel Hill two trap-door spiders with their nests, and placed them in the care of Professor Holmes for the University of North Carolina. The nests with their occupants were placed in the ground for the summer. On Nov. 12, after a careful search, Professor Holmes was able to find only one, and this one with difficulty, as for some reason it had dug through the lower end of the tube and was hidden in the earth. Later I shall offer what seems to me may be an explanation of this. On the morning of the same day the spider with its trap-door nest was placed in my keeping, which was the first intimation I had of the presence of such an agreeable neighbor.

At 4.30 P.M. I placed three and a-half inches of earth in a glass jar five inches in diameter and seven inches deep. Two-thirds of the surface of the soil was then covered with moss. In this the spider was placed, and the jar and its contents taken to my room, that I might, if possible, observe the operation of digging the tube and making the trap-door.

The results were most gratifying. Just before going to supper, at dusk, I observed that the spider had not undertaken the work. Upon returning, at 8.30 P.M., I found the task undertaken. The spider was resting in a hole about 20^{mm} deep by 22^{mm} in diameter, which she had excavated at one side of the jar. I placed the jar upon my study table, just beneath the light of a student lamp, so that while reading I could observe any movements made by my companion. The spider was resting in the hole with its legs partially folded, the anterior ones lying upon the edge of the excavation.

After I had been quiet for some time the spider began to move cautiously, and turning about slowly went head first into the hole, and dug from the bottom with her mandibles a pellet of earth about the size of a small pea. Then turning carefully around she placed it at the edge of the hole, where she pushed it off with the aid of her palpi, at the same time working her mandibles up and down. At first the spider seemed timid, and would cease operations upon the slightest movement on the part of myself. During the course of the evening three other persons, who came to my room, had the fortune to witness the operation of digging out the earth. The spider soon became bold, paid no attention to movements in the room, and permitted me to watch her very closely. Occasionally, by using both palpi at once, the dirt was flirted suddenly from the grasp of the mandibles with such force as to strike against the opposite side of the jar. Had it not been for this obstruction the dirt must have been thrown three or four feet.

After depositing each load on the edge of the hole, the spider would turn around again for another load, but before picking it up she would project the posterior pair of spinnerets about 5^{mm} from the abdomen and carefully knead the viscid liquid upon and around the freshly placed pellet of earth and over the edge for a distance of 4 or 5^{mm} for the purpose of making the soil adhere and prevent its caving in. In Plate XXIII, Fig, 4, the spider is shown in the act of removing a pellet of earth from her mandibles. In Fig. 5 is represented the application of the viscid liquid. The ends of the spinnerets are applied to the surface alternately, as shown in the illustration. The legs took no part in the application of the viscid liquid; nor did the liquid form a thread when the spinnerets were drawn from the surface, as I have since seen it when the spider was crawling about on the surface of the earth.[1]

At 11.30 o'clock, when the hole was about 4^{cm} in depth, to my surprise and pleasure the spider began to make the "trap door." Standing upon its fore feet and placing the spinnerets against the glass jar at the level of the edge of the hole, the spider covered the glass with the viscid liquid. Several pellets of earth were stuck to this, each time another portion of the viscid liquid being applied. After a depth of 5^{mm} had been built up in this way, which was to answer as the hinge, the spider cut a sprig of the moss and cemented it to the hinge so that the end projected above it. Small sticks, particles of moss and earth were constantly placed upon the edge of the growing door. Each time the spider would come out of the hole for new material, retreat backward, and turn half way around so as to apply it to the door. Placing the load

[1] As I am now writing, Jan. 16, 1886, 11.55 P.M., the spider is crawling about on the surface of a freshly prepared jar of earth. Sometimes the viscid liquid adhering to some object is drawn out in a band of silk 2^{mm} wide, and the pieces of moss strewn on the earth are loosely matted together in the path of the spider about the side of the jar.

on the under side of the partial door, she would carefully move it up to the edge. Then placing the distal portion of the palpi and anterior pair of legs above, while the proximal portion of these limbs and the ends of the mandibles were on the under side of the pellet and door, she would fit and press it in shape, as one would mold with the hand a moist portion of earth by pressing it into a thin sheet. This is illustrated in Fig. 7, Plate XXIII. Indeed it looked very much like the black bony fingers of a hand performing the work of pressing. The greatest pressure seemed to be brought to bear upon the rounded ends of the mandibles. After fastening on a portion thus, the spider would take an inverted position and apply viscid liquid along the edge and under the surface of the door, as shown in Plate XXIII, Fig. 6. She would then turn about and crawl out for more material. The hole being by the side of the jar, I could watch the operation both in the hole and upon the cover. By one o'clock in the morning (Nov. 13) the door was finished so that the spider could pull down the lid, which completely closed the entrance, nicely fitting in around the edge and appearing as if there was no hole nor spider, but through the glass the spider could still be seen.

At intervals during the construction of the door the spider would pull it down to observe where the next pellet should be placed in order to make the door fit the circular opening of the tube. Discovering this she would turn completely around, and not being able, with her head in the bottom of the tube, to see the place where she intended to put the next load, she would find it by feeling about with her spinnerets. The viscid liquid would then be applied and the pellet of earth fitted with extreme nicety.

Satisfied with the result of my experiment I retired. By daybreak I found that the excavation was continued after the completion of the trap door, the soil being deposited around the nest to raise the surface of the earth in the jar to a level with the top of the nest. Without close searching it was impossible to detect the door.

The mode of making the trap door by this spider differs very widely from that observed by other naturalists so far as I can find any record. Mr. Moggridge saw the female, *Nemesia meridionalis*, construct a trap door in captivity. He made a cylindrical, hole in a flower-pot of earth. Into this the spider disappeared. "During the night following the day of her capture she made a thin web over the aperture, into which she wove any materials which came to hand. The trap door at this stage resembled a rudely constructed, horizontal, geometrical web, attached by two or three threads to the earth at the mouth of the hole, while in this web were caught the bits of earth, roots, moss, leaves, etc., which the spider had thrown into it from above. After the second night the door appeared nearly of the normal texture and thickness, but in no case would it open completely, and it seemed the spider was too much disgusted with her quarters to think it worth while to make a perfect door."[1]

He also records the making of a door by a very young one of this species, in which the threads, except at the hinge, were cut so that the door would open and shut.[2]

The only thing he records which seemed at all analogous to the mode of making a trap door exhibited by the spider in my possession is that manifested in the enlargement of nests and trap doors by spiders as they grow larger, and consequently require nests of larger dimensions. This operation was not witnessed by him, however, but the additions to the size of the door were proven by measurements and observations upon nests of young spiders at different seasons.[3]

It would seem natural to suppose that in making slight additions from time to time to the edge of the nest, the spider would cement pellets of earth, pieces of moss, etc., to the edge instead of first spinning a web; unless the web is spun over the lower side of the door and made to project just far enough to fit the enlarged tube. In Plate XXIII, Fig. 8, can be seen eight concentric "lines of growth," as they might be termed, of the trap door, corresponding to the growth and needs of the spider. These I judge to represent the successive enlargements of the door concomitant with the enlarging of the tube. We can safely say that these additions were made by cementing the material, piece by piece, which forms each ring, to the edge of the door. These "lines of growth" are not present in the door made by the adult spider in captivity. I induced the spider to make the door the fourth time (Jan. 19, 1886) in order to observe if there was any regularity in the cementing of the particles, which might form

[1] Harvesting Ants and Trap-door Spiders, p. 118.
[2] Idem, p. 119.
[3] Idem, pp. 123, 127 and 150, and Supplement, p. 245.

these lines of growth in a door made by an adult spider. There is no such regularity. Indeed, this last door was made of about a dozen very large pellets of clay which, being very plastic, the spider was able to press each pellet into a sheet of considerable dimensions.

It is to be regretted that Mr. Moggridge did not have the opportunity of observing the manner of enlargement of trap doors made by the spiders which he studied, or that he did not offer some theory as an explanation. If the particles are cemented to the edge, it would be quite natural that the species of spider in my possession once made its door by first spinning a web across the mouth of the tube, and then weaving into it other material, as in the case of *N. meridionalis*, and that the habit, followed through life and successive generations, of making additions to the door by cementing particles to the edge, finally became so fixed that this mode of making additions to it became the permanent habit and type of construction of the trap door from the foundation! The rapidity, ease and intelligence manifested in this method of building up the door, piece by piece, certainly indicates a higher development of instinctive power. A perfect and neatly fitting and swinging door made in 1½ hours!

When I took the spider from her nest it was necessary to remove nearly all of the soil from the jar and take her from the lower end of the tube, as all efforts to attract her from the nest failed. As the soil was very loose and the nest not long made, the walls of the tube collapsed. In ten days the spider was returned to the nest. Though the trap door was capable of being used, and seemed to satisfy the spider's idea of the "fitness of things," it was in a very dilapidated condition. This agrees with what Mr. Moggridge says of the reluctance manifested by spiders to abandon an old nest. The examples cited by him are, that if a door be pinned back during the night, a second door will be made; that if the nest be covered with earth, the tube will be prolonged to the surface of the superimposed earth and a new trap door will be made; and that in some cases nests become inverted, when a door being made at the now upper end of the tube, the nest will have a door at each end.[1] The conduct of my spider under another condition farther illustrates this feature. Wishing to observe the habit of the spider, if possible, while the

[1] Harvesting Ants and Trap-door Spiders, pp. 121 and 122.

door of the nest was closed, I prepared a glass test tube, 17^{mm} in diameter, by placing 4^{cm} from the mouth a cork bottom, so that the spider might have something on which to stand while making the door. This, with the spider in it, I placed in the glass jar and surrounded it with earth to darken the walls, hoping thus, because of the firm smooth surface of the tube, she would not line it with silk, and by lifting the tube from the soil I could observe the position of the spider as it held down its door. The experiment was a decided success.

This was prepared at eleven o'clock on the night of Dec. 27 '85. Pieces of moss were strewn about the tube. By morning a perfectly fitting door, beautifully covered with moss, had been constructed (Plate XXIV, Fig. 3). About this time many visitors came to see the spider, and in pulling at the door to show how persistently she would resist its being opened, the hinge became loosened and the door was pulled down upon her. She held on to the door with such tenacity that I pulled it into bits in my efforts to remove it from her grasp. It was removed Dec. 30, '85, and on the following night she built another as neatly as the first. The hinge to this became loosened and the door moved down about 5^{mm} from the mouth of the tube. Here she strengthened the hinge by spinning a broad piece of silk, the width of the hinge, from the door down on to the wall of the tube. Several times in endeavoring to open the door I tore pieces from its edge, and in every instance the spider repaired it. Finally, when I wished to remove her from the tube I was obliged to push up on the cork bottom, and in this way crowd her out through the door. After this was done it was with some difficulty that she freed her posterior feet from the silk bag which she had constructed at the bottom, so firmly did she hold on.

I have this yet to add. In a note I have mentioned the wandering of the spider about in a jar of freshly prepared earth, Jan. 16. For three days she has been restless, and though several attempts have been made to dig a tube she had failed. I came to the conclusion that the soil was not such as she could work easily or satisfactorily. Wishing to have soil which would make a more durable tube than the loose soil in which I saw the first nest made, I used a large proportion of fine plastering sand mixed with black earth. This was wetted, and pieces of moss strewn over the surface. She tried several times to take up pellets of the earth, but seemed to be disgusted with its crumbling. She then tried to bore a hole by pushing down with her mandibles while turning her body around. She evidently wished to hide her head from the light, for after making a hole 2^{cm} deep she remained with her head at the bottom. To-day, Jan. 14, '86, the soil in the woods having thawed sufficiently, I prepared a jar of moist ferruginous clay, very much like that of which the nest is constructed that came from Pittsborough. Upon this I put a fine mat of fresh moss, covering the earth except a spot at one side $2\frac{1}{2}^{cm}$ in diameter. In this I placed the spider at noon. I then covered it from the light. As I returned to my room after dinner, she was resting in a hole 3^{cm} deep which she had excavated, and small pellets of earth were placed against the moss at the mouth of the hole. She would not work during the day unless I covered the jar from the light. During the evening, by lamp light, I had the pleasure of seeing her make another door. It required about one and a half hours. Only one piece of moss was used, and that I let drop into the hole while she was at work. This seemed very strange, for the tube was the only place not covered with moss, and to save her the trouble of cutting the moss I had strewn loosened particles about the hole. In this case all of the earth used in the construction of the door was taken from the bottom of the hole. The door being made almost entirely with the clay was very conspicuous in comparison with the surrounding moss; though the door fitted very neatly, the tube being built up to a level with the top of the moss. This time instead of making the hinge against the side of the jar it was made on the opposite side of the tube. Surely this persistence is equal to that shown by the spider who, making her web the thirteenth time, taught a general lesson of perseverance.

I was unable to understand how the resistance to opening the door was offered, if the spider fastened its fangs and *all* of its claws into the under surface of the door, as Mr. Moggridge states.[1] A reference to Plate XXIV, Figs. 3 and 4, will show the results I reached in the experiment when the spider was induced to make a trap door to the mouth of a glass test tube. The portion of the tube from *b* to *c* was not lined with silk. The spider, evidently not admiring the cork at *d* for a bottom to her nest, carried in pellets of earth and bits of moss as shown at *g*. She

[1] Harvesting Ants and Trap-door Spiders, pp. 95–96.

then spun a short bag of silk, *f*, which was attached by the mouth to the walls of the tube at *c*, and rested on the piece of of cork. The mouth of the test tube was lined with silk from the edge for about 5^{mm} to 7^{mm}. The ends of the silk lining at *b* and the silk bag at *c* were for some distance transparent, so that I was enabled to see the spider fairly well. As can be seen in Fig. 4, the spider clings to the bag of silk at the bottom (or walls of the tube) with the claws of her two posterior pair of legs, and to the under surface of the door with her fangs and the claws of her anterior pair of legs. By partially lifting the door I was enabled to see the hold upon the door, and when I pushed the spider out of the tube, as before stated, I found her feet entangled in the bag of silk. The manner in which this spider holds down the door is precisely the same as that described by Emerton[1] in the case of *Cteniza californica*, except that he states the "third and fourth pairs of legs are pressed out against the walls of the tube."

The nest of this spider belongs to the simple, unbranched type with shallow cork door. The door belonging to the nest in which the spider was caught (Plate XXIV, Fig. 1) measures 3 to 4^{mm} in thickness; the edge is beveled and fits neatly in the mouth of the tube. The door measures 25^{mm} across near the hinge; the tube 60^{mm} in length. The walls are badly collapsed, and the lower edge ragged and open. It will be remembered that the spider was found in the earth below the tube when the nest was taken up in November. The first nest which the spider made under my observation was left open at the bottom, and when I attempted to take her out, finding she could not hold down the door, she attempted to bury herself in the soil at the bottom of the tube. The question naturally arises, Is this not left open as a last means of escape from enemies? I am inclined to think it is, in some cases at least with this species, as this is the only resort for safety after the door is open. Further observation is needed on this point.

The trap door of this nest is so hung that it tends to close itself. In Fig. 2, Plate XXIV, at *a* are patches of silk that are drawn on the stretch when the door is open. When all resistance is removed these tend to close the door.

The subject of the food of trap-door spiders is an interesting

[1] Structure and Habits of Spiders, p. 45.

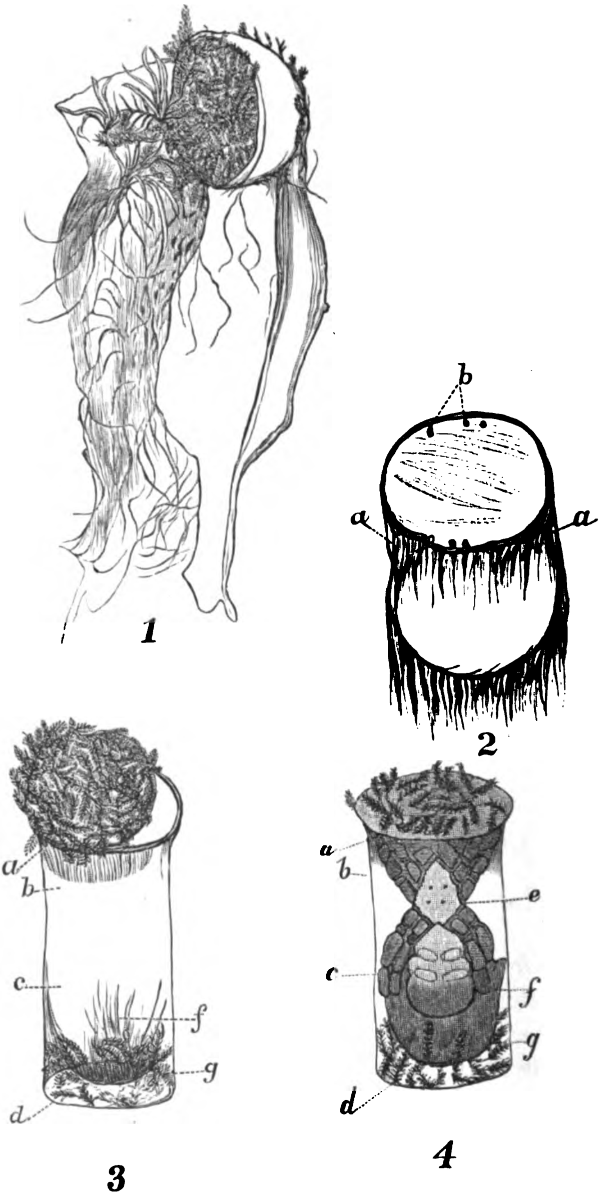
one, and much is yet to be learned of their habits in this respect. While I had the spider out of her tube I offered her several house-flies, holding them by one wing with the forceps near her head. The struggles of the fly attracted her attention. With a quick sweep of the palpi and anterior pair of legs she would clutch the fly and place it between her powerful mandibles, crushing it immediately.

She held some of these about one minute, but I very much doubt her having derived any nourishment from them. One of the smaller species of the flies belonging to the genus Tabanus was offered her. It seemed only to frighten her, as she could not be made to touch it even by being angered, but would turn and run away as if in great fear. After returning the spider to her nest, Dec. 8, I placed in the jar two ants and a small carabid beetle. The ants hid themselves in the earth. Dec. 14 the beetle was still unharmed, and I concluded the spider did not come out for food. I then lifted the trap door and placed the beetle inside. Dec. 16 I found the broken hard parts of the beetle strewn about just outside the nest. It had been killed, the soft parts eaten by the spider, and the parts of the skeleton ejected from the nest. Jan. 17, '86, I placed a half dozen large yellow ants in the jar.[1] As they attacked her she would catch and crush them, but I did not see that she ate any of them.

Jan. 2, '86, which was almost like a summer day at Chapel Hill, I went into the woods for the purpose of collecting some moss. While tearing up a large patch of this at the foot of a tree, I discovered a hole which I thought to be the nest of a trap-door spider. I dug down into the tube and found at the bottom a spider belonging to this family. In the afternoon I found several nests and one more female spider. Under some stones I found a male. I placed them in jars of earth containing moss. One of the females escaped, the other built a nest and made a slanting double door which might be compared to an outside cellar door. Each door is made of moss cemented with silk and hung by a semicircular hinge. These the spider will open and shut at pleasure, sometimes fastening them together with a thread of silk. In both of the nests in which I found these spiders there were the remains of ants. I had intended to illustrate and describe farther the nests and habits of these found by myself at

[1] The spider was not in her nest.

PLATE XXIV.



G.F. Atkinson. del.

A new Trap-door Spider.

Chapel Hill, as they are lively creatures and seem to offer interesting objects for study as to habit, food and architecture. But as this article is already long, and I wish to make farther collections and study their habits more closely in captivity, I will reserve the subject for a future time.[1]

EXPLANATION OF PLATES.

PLATE XXIII.

FIG. 1.—Spider, natural size, dorsal view.
" 2.— " " ventral "
" 3.— " " side "
" 4.—Spider in the act of unloading a pellet of earth while excavating the tube. *a*, pellet of earth.
" 5.—Spider applying viscid liquid to the freshly placed pellet of earth. *a*, spinnerets.
" 6.—Spider applying viscid liquid to the edge of the partially constructed door. *a*, spinnerets; *b*, door; *c*, pieces of moss.
" 7.—Spider in the act of fitting to edge of the door a pellet of earth, *a*.
" 8.—Trap door showing eight concentric rings which represent the successive additions to the edge of the door corresponding to the enlargement of the tube. *a*, hinge.

PLATE XXIV.

FIG. 1.—Natural size of nest in which the spider was caught.
" 2.—Trap door open. *a*, bands of silk which tend to close the open door; *b*, claw and fang marks of spider made while holding down the door.
" 3.—Nest made in glass test tube. *a*, hinge; *f*, bag of silk; *d*, cork bottom; *g*, pieces of moss and earth.
" 4.—Spider in act of holding down the door while in the nest. All natural size.

——:o:——

A FEW LEGENDARY FRAGMENTS FROM THE POINT BARROW ESKIMOS.

BY JOHN MURDOCH.

DR. Rink, in his "Tales and Traditions of the Eskimo," has already called attention to the fact that among the rare cases that we have of any Eskimo tradition from the western regions, in what is now the territory of Alaska, there is one legend, that of the sun and the moon, which is identical with a well-known Greenland tradition (p. 237), and from this draws additional evidence of the identity of the Eskimo race over this extensive region.

The following fragments of stories were collected by the writer

[1] A description of these spiders I reserve for a future time when a fuller collection is made and habits more clearly observed.

and other members of the United States International Polar Expedition from the Eskimos of Point Barrow, Alaska, which is the extreme north-western point of the continent of North America, during a stay of two years (from 1881 to 1883). The fact that several of them show features indicating a relationship with well-known Greenlandic stories seems to the writer to render them, scanty as they are, worthy of publication.

Two or three of them have already been published by Lieut. Ray, the commander of the expedition, but as they appeared in a government publication,[1] perhaps not accessible to all readers, it will not be out of place to repeat them here.

Occupied as our party was with the manifold routine scientific work of the station, it was exceedingly difficult to get hold of any of the traditions of the natives, though they showed no unwillingness, from superstitious or other reasons, to talk freely about them. In the first place there were so many (to the Eskimos) more interesting things to talk about with us, that it was difficult to bring the conversation round to the subject in question. Then our lack of familiarity with the language was a great hindrance to obtaining a connected and accurate version of any story. The jargon, or kind of *lingua franca*, made up of Eskimo roots and " pigeon English " grammar, which served well enough for every-day intercourse with the natives, enabled us, with the help of expressive gestures, to get the general sense of the story, but rendered it impossible to write down an Eskimo text of the tale which could afterwards be translated. Moreover, the confusion and difficulty was still further increased by the fact that two or three people generally undertook to tell the story at once.

In writing out the following stories I have endeavored to avoid introducing ideas and expressions of my own, and to adhere as closely as possible to the simple sense of the brief disconnected sentences of the narrators.

1. How people were made. Long ago, Aselu, a dog—" where he came from I did not hear "—was tied to a stick. He bit the stick [*i. e.*, set himself free] and went into the house, where he had intercourse with a woman, who gave birth to men and dogs.

The belief that a dog was one of their remote progenitors is a very common one among savages. According to Egede (Green-

[1] Report of the United States International Polar Expedition to Point Barrow, Alaska. By P. H. Ray. Washington, 1885.

land, p. 195) the Greenlanders believed that white men were the offspring of a similar union between a woman and a dog. (The same story is also referred to in Rink's "Tales," &c., p. 471.)

2. Another account of the origin of human beings. In the east, a tall tube [like a reed. The narrator to illustrate this pointed to one of our bamboo fishing-rods] stuck up from the ground. A man broke the tube. "Behold, many men and women!"

3. The origin of reindeer and fishes. Both reindeer and fishes were made by a mythical person of whom we got only a vague account, though he was often mentioned. He was said to be a little man with long tusks like a walrus, and many of the little Eskimo figurines and masks of ivory, soapstone or wood, which we brought home from Point Barrow, represent such a being, and are, perhaps, meant for images of this person.

When the deer was not, this man made one out of earth. The deer all had large teeth in the upper jaw and were "bad"—they bit people. So he said to them: "Come here!" and when they came he pulled out these teeth. Now they are "good."

The reindeer, of course, like the sheep and other ruminants, has no incisor teeth in the upper jaw, and this myth is certainly an ingenious way of accounting for this fact, which must have seemed very strange, since all the other animals known to the Eskimos are well supplied with teeth in both jaws.

When the fish were not, this man hewed a piece of wood by the river side with his adze. The chips fell into the water and were fishes.

There seems to have been a similar myth in Greenland. According to Crantz: "They say fishes were produced by a Greenlander's taking the shavings of a tree, drawing them between his legs and casting them into the sea" (History of Greenland, Vol. 1, p. 204); and Egede tells a similar story (Greenland, p. 196).

4. Thunder and lightning. It rarely thunders at Point Barrow, but the natives know what these phenomena are and account for them as follows: Long ago a grown person and a child went up into the sky, carrying a dried sealskin and torches of tar. With these they make the thunder and lightning, apparently by waving the torches and rattling the sealskin.

Dr. John Simpson, the surgeon of the *Plover*, the English discovery ship that wintered at Point Barrow thirty years before us, gives a version slightly different but agreeing in the main with this.

Evidently related to this is the Greenland tradition referred to by Crantz (Vol. 1, p. 233) that the thunder is caused by "two women stretching and flapping a dried sealskin." Egede (p. 207) gives the story in greater detail. The thunder and lightning are made by two old women who live in a house in the air. They now and then quarrel about a dried sealskin, and while they are fighting down comes the house and breaks the lamp, so that the fire flies about.

5. The story of the Kokpausina. Long ago there were five very strong brothers, Kokpausina, Kokkaun, Inaluoktuo, Nimna and Pûkanigarua. (The narrators were particular to impress it upon us that these men were not especially tall, but very stout and strong. The strength of Kokpausina especially seems to have become proverbial, for an Eskimo once compared the great, powerful hand of an old whaleman, one of our party, to that of Kokpausina.) Kokpausina lived at Pernye [*i. e.*, "the elbow," the summer campground in the bend of Elson bay, between Point Barrow and the station], Kokkaun east of Point Barrow on the seashore, Inaluoktuo inland in the south, Nimna at Dease inlet, and Pûkanigarua at Cape Smyth. Kokpausina found two little orphans asleep and thrust excrement up their noses [apparently from sheer malevolence, though we never succeeded in making the natives understand that we wanted to know the reason of this action.] So they went home and made a little bow and arrows, short enough to hide under the jacket, but strong enough to shoot through a walrus-hide dried before the fire [and therefore nearly as hard as iron]. Then they went to Pernye and saw Kokpausina, with his back towards them, stooping over. So they shot him in the buttocks and the arrow came out at his collar bone, and he died.

His great shoulder-blade and some of his other bones are still at Pernye. [Natives who came down from the Point Barrow village to the station once or twice told the writer that they had seen Kokpausina's bones at Pernye on their way down. One went so far as to bring us down a rather large human jaw bone from the old cemetery near Pernye, saying that it was Kokpausina's.]

This story, which we heard from several narrators without any essential variation of names or incidents, and without being able to get more details, is the skeleton of one of the semi-mythical traditions so common in Greenland, which may really refer to some actual occurrences in ancient times, but which have been localized and adapted to suit the region in which the narrator lives.

The death of Kokpausina bears a strong resemblance to the final catastrophe of the Greenland story of Kagsuk (see Rink's "Tales," &c., p. 431), which is said to have taken place in Greenland, in the districts of Holsteinborg and of Sukkertoppen, and according to Dr. Rink is perhaps a variant of an older tale only localized in this way. In this story the wicked Kagsuk, after committing various deeds of violence, at last murders the sons of *two* old men "clever in magic spells." To revenge themselves they prepare "bows of an *arm's length*," and while others engage Kagsuk's attention in front they creep up behind, escaping observation by magic, and shoot him dead.

It seems hardly too bold a statement to say that if Kagsuk and Kokpausina were real persons at all they were one and the same man, who lived neither at Sukkertoppen nor at Pernye, but somewhere in the common home of the prehistoric Eskimos, before the Greenlanders started on their weary journey towards the east and the men of Point Barrow on their perhaps longer journey towards the setting sun.

It is interesting to note that the *five* very strong and (apparently) wicked brothers who appear in this story are evidently the same as the "band of five brothers, generally called 'a lot of' brothers or men" who, according to Dr. Rink, figure in so many of the Greenland tales as the personification of haughtiness or brutality.

6. A murder at Cape Smyth. Ụdlimau was once given as the name of one of Kokpausina's four brothers, but the narrator afterwards corrected himself and said, as did other natives also, that Udlimau was a bad man who long ago lived at Utkliavwing (Cape Smyth) and who murdered Kumnero as he lay asleep beside his wife by cutting him across the bowels. The house where this murder was committed was pointed out to us in the village. This is probably an account of an actual occurrence, as is the following:

7. The people who talked like dogs. Long ago, when there

was no iron, five families had their houses at Isûtkwa (the site of the signal station, where several mounds indicate the position of the former village). They were called Isûtkwamiun ("they who live at Isûtkwa"), and they talked like dogs. They said "imeklunga, wa! wa!" ("I want a drink, bow-wow!").

The following fragment, however, for which Lieut. Ray is my authority, and which was also related to Dr. Simpson thirty years before, which both these gentlemen think indicates that these Eskimos are really acquainted with an unexplored land in the north, is in my opinion more probably referable to the same category as the numerous tales of the eastern Eskimo about the mythical land of Akilinek.

8. Iglu Nuna ("House country"). In the north is a country where the Iglumiun live. When all men wore *one* labret [the characteristic lip-stud of the western Eskimos, of which a pair is now universally worn in the under lip, one at each corner of the mouth. The expression means a very long time ago, as the single labret has long been out of fashion, and a few only are preserved as heirlooms or amulets], a man with his sledge and dogs lost his way on the ice and traveled many days till he came to a country he had never seen before, where there were people who spoke his language.

We also heard of various fabulous animals, though in many cases the names which in Greenland are applied to animals known only by tradition, and which therefore have grown into fabulous monsters, are still used for the animals to which they properly belong, as in Labrador and elsewhere, for instance, *amaro* means the wolf, and *avwinga* the lemming, while in Greenland the *amarok* and *avingak* are semi-supernatural creatures that figure in many of the old stories.

The Greenlandic word *kilivfak* or *kiliopak*, which there means an animal with six or even ten legs, appears at Point Barrow as at the Mackenzie river in the form *kiligwa* as the name of the mammoth or fossil elephant (see also Rink, "The Eskimo Dialects," Journal of the Anthropological Institute of Great Britain, November, 1885). We heard none of the fanciful myths about this animal which have been reported by various travelers from the shores of Bering sea, but the word was in common use, especially as the name of the fossil ivory, which is very plenty and much used by the western natives for various purposes.

It is interesting to note in this connection that one of the little ivory images brought home by our party from Point Barrow represents a bear with *ten* legs, said to have been seen once at Point Barrow, and evidently a blood relation of the many-legged *kilivfak* of the Greenland stories.

Another fabulous beast was the *ugruna*. "There are none now on the land. It has gone away, only the bones [remain]." This name appears to be applied to an extinct species of ox or buffalo, whose bones they sometimes see in the interior, probably along the banks of the rivers. We procured several teeth of the *ugruna* which had been worn as amulets. As in Labrador this name is also applied satirically to the smallest mammal known to the Eskimos, a little shrewmouse.

As elsewhere on the American continent, the Red Indian, who in Greenland, like the wolf, has become a fabulous being, dwelling in the mysterious inland country, is called by the contemptuous name, "son of a *nit*"—Itkûdling, the Ingalik or "Ingaleet" of Norton sound, which is plainly the same word as the *erkilek* of the Greenland traditions.

Outside of the strict field of legendary history or tradition, the religious ideas and superstitious observances of these people, as far as we had the good fortune to observe them, show a great resemblance to those of the Greenlanders before their conversion to Christianity. So strong is the resemblance in this and in other respects that I feel confident that an intelligent observer who should devote himself to the collection of the traditions of the Eskimos of Point Barrow, as Dr. Rink has so ably done for the Greenlanders, would find here the greater part of the older traditions of the Greenlanders in a recognizable shape.

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HISTORY OF CELERY.

BY E. LEWIS STURTEVANT, M.D.

IF we consider cultivation as embracing only the removal of a plant to fertile soil and its protection from injury from crowding, the only marked effect of the continuance upon a plant through itself and its offspring seems to be embraced in the one word expansion, *i. e.*, increase of size. If we enlarge the meaning of cultivation so as to embrace selection and the cross-fertilization of the flowers which yield seed for future use, the subject becomes more complicated, and we find it difficult in all cases to connect the sequence of cause and effect. One fact, however, through careful observations, seems undoubtedly true, that by selection alone, without the assistance of the break caused by a cross-fertilization, changes in our plant are extremely slow, and many generations are required to obtain and fix any change other than increase which is sufficient to be noted by the casual eye. In support of this view we can direct attention to the little change that has been produced by centuries of culture in those plants which represent but improved forms of a wild species, such as the parsnip, scorzonera, salsify, etc., among roots; and we may also call attention to the stability of type-form during centuries of culture in the eggplant, pepper, and I may even add the pumpkin. Perhaps one of the most interesting instances of increase of size without change of type can be seen in the watermelon. The old herbalists figure this fruit of small size, but as is very likely, only small varieties were commonly grown in Europe. John Bauhin, whose history of plants was published in 1650, many years after it was written (he died in 1613), states the watermelon to be so large that one could scarcely embrace it with the two hands, "quos fere ambabus manibus ambias." Marggravis, whose history of natural productions of Brazil was published in 1648, describes the watermelon as being as large as one's head, "magnitudine capitis humani."[1] That our present types of fruit were then known is evidenced in many ways, but can be given succinctly by Caspar Bauhin's statement in his Pinax, edition of 1623, that some have a green skin, others a skin spotted with dingy white; the flesh of some red, of others white; the seeds black, red and tawny, in varieties. Ray describes the fruit as round, or globose or even elliptical. In modern times we have fruit so large that my arms cannot embrace the oval, and a weight of ninety-six pounds has been claimed, probably with justice.

In seeking for a good illustration of the stability of type joined with a change produced by cultivation and selection, I have taken the celery, as this vegetable seems to be of modern

[1] Cardanus, however, in his de rerum varietate, 1556, apparently refers to a watermelon, "Magnitudo quandoque tanta, ut homo expansis brachiis vix una amplecti queat;" but then Cardanus was dealing with wonderful things! He calls it "Anguria, qua melopeponem ob it Galenus vocat, quod non distincta sit canalibus ut pepon sed rotunda ut pomum."

origin, and the variations from the wild plant have been apparently deemed great, although really but slight, except in expansion produced by freedom of growth and changes which have slowly accumulated through selection.

The celery has originated from the *Apium graveolens* L., a plant of marshy places whose habitat extends from Sweden southward to Algeria, Egypt, Abyssinia, and in Asia even to the Caucasus, Beloochistan and the mountains of British India,[1] and has been found in Fuegia,[2] in California[3] and in New Zealand.[4] It is supposed to be the *selinon* of the Odyssey, the *selinon heleion* of Hippocrates, the *Eleioselinon* of Theophrastus and Dioscorides and the *Helioselinon* of Pliny and Palladius. It does not seem to have been cultivated,[5] although by some commentators the word interpreted as smallage has a wild and cultivated sort. Nor do I find any clear statement that this smallage was used as food, for *sativus* means simply planted as distinguished from growing wild, and we may suppose that this Apium, *if* smallage was meant, was planted for medicinal use. Targioni-Tozzetti[6] says this Apium was considered by the ancients rather as a funereal or ill-omened plant than as an article of food, and that by early modern writers it is mentioned only as a medicinal plant. This seems true, for in the books in my library I find that Fuchsius, 1542, does not speak of its being cultivated, and implies a medicinal use alone, as did Walafridus Strabo in the ninth century; Tragus, 1552, likewise; Pinaeus, 1561; Pena and Lobel, 1570; also Ruellius' Dioscorides, 1529; Camerarius' Epitome of Matthiolus, 1586, says planted also in gardens, "Seritur quoque in hortis," and Dodonaeus, in his Pemptades, 1616, speaks of the wild plant being transferred to gardens, but distinctly says not for food use. According to Targioni-Tozzetti,[7] Alamanni in the sixteenth century speaks of it, but at the same time praises Alexanders for its sweet roots as an article of food. Bauhin's (1623) name, *Apium palustre* & *Apium officinarum* indicates medicinal

[1] De Candolle. Orig. des Pl. Cult., 71.

[2] Ross. Voy. to the South seas, II, 298. *Apium antarcticum*, Cook's Voy., ed. 1769, I, 28.

[3] Nutt. Jour. Acad. Phila., n. ser., I, 183.

[4] Forster. Pl. Esc., 67.

[5] Bodaeus and Scaliger's Theophrastus, ed. 1644, p. 804. Ruellius' Dioscorides, 1529, Pliny. Grandsagne. ed. Palladius, Gesners Script, rei rust.

[6] Hort. Trans., 1854, 144.

[7] l. c.

rather than food use, and J. Bauhin's name, *Apium vulgare ingratus*, does not promise much satisfaction in the eating. According to Bretschneider[1] celery, probably smallage, can be identified in the Chinese work of Kia Sz'mu, the fifth century A. D., and is described as a cultivated plant in the Nung Cheng Ts'nan shu, 1640. We have a mention, however, of a cultivated variety in France by Olivier de Serres in 1623,[2] and in England the seed was sold in 1726 for planting for the use of the plant in soups and broths,[3] and Miller[4] says, in 1722, that smallage is one of the herbs eaten in the spring to purify the blood. The cultivated smallage is even now grown in France under the name of *Celeri a couper*, differing but little from the wild form. The number of names that are given to smallage indicate antiquity, such as Arabic *Asalis*, Italian *apio*, German *Eppich*, Spanish *Ferexil dagoa*, French *ache*,[5] Egypt *Kerafs*,[6] English *smallage*, etc.

The prevalence of a name derived from one root indicates a recent dispersion of the cultivated variety. Vilmorin[7] gives the following synonyms: French *Celeri*, English *celery*, German *Selleree*, Flanders *Selderij*, Denmark *Selleri*, Italy *Sedano*, Spain *apio*, Portugal *Aipo*, and M'Intosh[8] gives for the Spanish *Apio hortensis*. The first mention of the word celery that I have observed is in Walafridus Strabo's poem entitled "Hortulus," where he gives the medicinal uses of Apium, and in line 335 uses the word as follows:

"Passio tum celeri cedit devicta medelæ."

The disease then to celery yields, conquered by the remedy, as it may be liberally construed, yet the word *celeri* here may be translated quick-acting, and this suggests that our word *celery* was derived from the medicinal uses. Strabo wrote in the ninth century, having been born A. D. 806 or 807, and dying in France in 840. Targioni-Tozzetti[9] says it is certain that in the sixteenth century celery was already begun to be grown for the table in Tuscany. I cannot find any mention of *celery* in Fuchsius, 1542; Tragus, 1552; Matthiolus Commentaries, 1558; Camerarius' Epitome, 1558;

[1] Botanicon Sinicum, 78.
[2] Ponce. La. Cult. Maraich. Also Heuze, Les Pl. Alim., I, p. 5.
[3] Townsend. Seedsman, 1726, 37.
[4] Bot. Offic., 1722.
[5] Pinaeus, 1561.
[6] Forsk.
[7] Les Pl. Pot., 72.
[8] Book of the Garden, II, 150.
[9] l. c.

Pinaeus, 1561; Pena and Lobel, 1570; Gerarde, 1597; Clusius rar. plant., 1601; Dodonaeus, pempt., 1616; or in Bauhin's Pinax, 1623. Parkinson's Paradisus, 1629, mentions Sellery as a rarity, and names it *Apium dulce*. Ray in his Historia plantarum, 1686, says the smallage transferred to culture becomes milder and less ungrateful, whence in Italy and France the leaves and stalks are esteemed as delicacies, eaten with oil and pepper. The Italians call this variety *Sceleri* or *Celeri*. The French also use the vegetable and the name. He adds that in English gardens the cultivated form often degenerates into smallage. Quintyne, who wrote[1] prior to 1697, the year in which the third edition of his Complete Gardener was published, says, in France "we know but one sort of it." Celeri is mentioned, however, as *Apium dulce, Celeri Italorum* in Hort. Reg. Par., 1665;[2] in 1778 Mawe and Abercrombie note two sorts of celery in England, one with the stalks hollow and the other with the stalks solid; but in 1726 Townsend[3] distinguished the celeries as smallage and sellery, and the latter he says should be planted "for Winter Sallads, because it is very hot." Tingburg[4] says celery is common among the richer classes in Sweden, and is preserved in cellars for winter use. In 1806 M'Mahon[5] mentions four sorts in his list of garden esculents for American use. It is curious that no mention of a plant that can suggest celery occurs in Bodaeus and Scaliger's edition of Theophrastus, published at Amsterdam in 1644.

The summary of our investigation hence is, that we find no clear evidence that smallage was grown by the ancients as a food plant, but that if planted at all it was for medicinal use. The first mention of cultivation as a food plant that I note is by Olivier de Serres, 1623, who calls it *ache*, while Parkinson speaks of *celery* in 1629, and Ray indicates the cultivation as commencing in Italy and extending to France and England. Targioni-Tozzetti states, however, as a certainty that celery was begun to be grown in Tuscany in the sixteenth century. The hollow celery is stated by Mawe[6] to have been the original kind, and is claimed by Cobbett[7] even as late as 1821 as being the best.

[1] Eng. ed., 1704.
[2] Tourn. Inst., 1719, 305.
[3] l. c.
[4] Hort. Culin., 1764, 25.
[5] American Gardeners' Kalendar.
[6] Mawe and Abercrombie. Gardener, 1778.
[7] American Gardener.

The first celeries grown seem to have differed but little from the wild plant, and the words celery and [cultivated] smallage were apparently nearly synonymous at one time, as we find cultivated *ache* spoken of in 1623 in France, and at later dates *Petit celeri* or *celeri a couper*, a variety with hollow stalks cultivated even at the present time for use of the foliage in soups and broths. Among the earlier varieties we find mention of hollow-stalked, stalks sometimes hollow, and solid-stalked forms; at the present time the hollow-stalked forms have become discarded. Vilmorin[1] describes thirteen sorts as distinct and worthy of culture in addition to the *celeri a couper*, but in all there is this to be noted, we have but one type.

A curious circumstance is that smallage took on the appearance of celery before its use was commonly recorded, if at all, as a salad plant, as is evidenced by the drawings herewith reproduced in reduced form. The first drawing is substantially the same as that in Fuchsius, 1542; Tragus, 1552; Pinaeus, 1561; Tabernaemontanus ic., 1590, or Gerarde, 1597, and Dodonaeus, 1616, and is taken from Matthiolus' Commentaries, 1558; this represents the common expression of the herbalists as to the appearance of *Apium palustre* at this time. The second picture is from Camerarius' Epitome of Matthiolus, 1586, and represents the form we call celery, but hollow stalked as at first noticed. The third picture is taken from Decaisne and Naudin's Manuel de l'amateur des jardins, and represents the unblanched plant of one of our most improved varieties. These pictures suggest the same ideas that I have previously shown to hold true for the dandelion, viz., that our improved strains originated from natural sources, and are not cultural in their beginnings.

Take the wild smallage, transfer to fertile soil and protect from crowding, and we should expect increase of size to the plant; earth up for the purpose of blanching and we should expect to gain increased weight to the leaf-stalks; a long-continued selection of the best plants for seed-growers would gradually succeed in forming the solid stalked; the growing of varieties from the earliest seed would tend toward earliness; the occasional growing through accident from unripe seed would tend towards obtaining a curled-leaf form with dwarf habit, etc. We may hence say that all our celeries in form are not changed from the orig-

[1] Les. Pl. Pot.

inal except in unessential points correlated with size and selec-

Fig.1

FIG. 1.—*Apium palustre* (Matth. Comm., 1558, p. 362). FIG. 2.—*Apium palustre* (Cam. Epit., 1586, p. 527). FIG. 3.—*Celeri plein blanc* (Decaisne and Naudin).

tion. In quality celeries have tended to become milder, until now some of our varieties, such as the Boston market, are of a very delicate taste, far different from the sort spoken favorably of by Townsend in 1726 as very hot and very slow growing.

It is probable that some original variation in quality discovered in the wild plant suggested cultivation, for among a people like the Italians, with whom high aromatic taste seems popular, the strong savor of the smallage would present little objection, if only grateful to them; or that its use was suggested by some popular idea of its value as a medicinal food, as seems probable. That there is great variety in wild plants in respect to flavor, we have every reason to believe. Smallage, described by most botanists as a suspicious if not dangerous plant for eating, yet in Fuegia was found palatable and healthful by the sailors of the exploring ships,[1] and in New Zealand described by Forster[2] as truly pleasant and salutary for scorbutic sailors. The use in Italy as a medicinal food, and the introducing to garden culture, with blanching, etc., would improve the flavor and increase its use, and improvement once initiated and recognized would necessarily continue, and stability of type-form would also tend to continue, as the seeding habits of the garden plant is not favorable to cross-fertilization with the wild or allied species, it being a biennial, and not usually seeding alongside of other species with which crosses might occasionally occur.

We have now in celery an improved, not changed, wild plant, which does not now tend to revert to the wild form, as it seemed to have done at the first, and a good illustration of the fixity of a garden form species. The present form will undoubtedly continue unchanged for a long period, unless cross-fertilization with another species-variety is brought to pass. It would be of garden interest to grow and cross the species-forms from different portions of the globe with our garden varieties, as analogical reasoning would suggest possibilities as yet unsuspected in practice.

[1] Ross, l. c. Cook, l. c.
[2] l. c.

THE YELLOW-BILLED MAGPIE.

BY BARTON W. EVERMANN.

DURING two years spent in Ventura county, Southern California, I became quite familiar with this handsome yet noisy bird of plebeian tastes. The yellow-billed species seems to be restricted in its range to California, throughout which State it is locally abundant.

One of the great industries of Southern California is wool-growing; the valleys and hillsides are covered with flocks of sheep, from a score to several thousands in number; and nearly every cañon has its corral to which the herder and his faithful dog drive the flocks at eventide. Here they are shut up and guarded through the night. In the morning they are again turned loose to feed upon the burr clover, alfillarilla (or "fillareé"), and such other stuff as can cause only sheep and mules to thrive. In and about these corrals are various kinds of filth—carcasses of sheep that have died of disease or starvation, bodies of dead lambs and the refuse of the sheep which the herder has slaughtered for his own larder, for jerked mutton and tortillas constitute the chief part of his meager bill-of-fare. Such a place as this is a paragon of restaurants to the magpies. Here they can be found in the early morning, in the evening, and at any other time of day when they happen to be hungry. Here they come to feed upon the filth, keeping up an almost incessant chattering, crying and scolding, which if translated into intelligible English would certainly bristle with oaths and slang. For there, where the English sparrow has not yet found its way, the magpie represents the "hoodlum element" in bird society. But when the English sparrow invades its domain, the magpie will become, by comparison, a most estimable member of the avian fauna of that region.

Almost any cañon which has a considerable sheep corral and is supplied with a few scattered clumps of live oaks, cottonwoods or sycamores, is quite sure to have its colony of magpies. And when you enter one of these cañons you are apt to know of their presence long before you come within gunshot of them, unless they, as is sometimes their custom, remain quiet and hidden until you are near them, when they open fire upon you with volleys of oaths, imprecations and maledictions, which nothing but a charge of shot will stop.

Such a place as this is Wheeler cañon, a few miles down the Santa Clara valley from Santa Paula. By former visits to this cañon I had kept myself informed as to the progress these birds were making in their nesting. So on April 2, 1881, Mr. Fred. Corey and I paid the cañon a visit, believing that many "full sets" would be gotten. We started from home early in the morning and drove down to the cañon, fully prepared to spend the day. As we drove leisurely along the foot of the mountain slope, numerous brown birds (*Pupilo fuscus crissalis*) and valley quails (*Callipepla californica*) scurried from our path and hid themselves in the sage-bush chaparral which there abounds; and an occasional burrowing owl (*Speotyto cunicularia hypogæa*) would salute us with a school-boy bow as we passed. Where the cañon opens into the valley are many large spreading live oaks which, with their dark-green foliage and spreading form, resemble large apple-trees. Many of them have beautifully rounded tops, whose bases are only a few feet from the ground, and whose small dark-green leaves are so thickly set that it is impossible to see among the branches except from below. Farther up the cañon are a number of cottonwoods and a few willows, and still farther more oaks and several sycamores.

He who has collected only here in the East hardly knows how rich may be the results of a day spent in such a cañon as this. Here every tree could be climbed with no great difficulty, and anything it might contain was nearly always obtainable. When we reached the sycamores and cottonwoods the hooded and Bullock's orioles, happiest of all the cañon's happy birds, flitted among the green leaves, delighting the eye with their royal dress, and the ear with their rich melody of song. And a pair of magpies flew up from the edge of a little stream where they had come to make their morning toilet, and perched upon a cottonwood near by. Emphasis was given to their scoldings by excited jerkings of the tail and body after the manner of the jay. But as we had decided to begin collecting at the upper end of the coñon, we passed on without disturbing the nest which we plainly saw in the tree's top. As we neared the upper end of the cañon a California vulture (*Pseudogryphus californianus*) rose from the ground in front of us, where lay a dead pig upon which it was feasting, and soared away to the higher mountains. I know of no bird of more majestic flight than this great vulture of our

Western coast. While rising from the ground his movements are anything but graceful; he starts with a few very awkward steps and still more awkward flaps of his immense wings, but after reaching an elevation of fifty to seventy-five feet, flapping of the wings ceases, and as he circles above you, ascending higher and higher on motionless wings, he proves himself king of the soaring birds. But the magpie was the object of our trip, and to her we must return. Our time was well selected, for the nesting was at its height. The large globular nests were seen in the tops of a number of trees, and most of those that we climbed to contained good sets of eggs. We obtained nine sets altogether. Five nests were found in sycamores and contained three, six, seven, seven and nine eggs respectively. The full nest complement for each of the first two sets had evidently not been reached, as the eggs were perfectly fresh. Incubation had scarcely begun in the two sets of seven each; and the nine eggs of the other set showed but slight embryonic changes.

Two sets of eight eggs each were taken from nests in live oaks, and with these incubation had proceeded several days. One beautiful set of eight eggs was found in a nest in the top of a willow near the lower end of the cañon. In only two or three of the eggs were embryonic changes visible. But one nest was found in a cottonwood, the one we had "spotted" in the morning, and but a short distance from the willow just mentioned. In this nest we found four fresh eggs. Thus from the nine nests we got sixty eggs, which we regarded as a pretty fair day's collecting. From the above facts it seems safe to conclude that the usual nest complement of the yellow-billed magpie is from seven to nine eggs, and that the sycamore is the favorite tree in which to nest in that region.

The nest is a large globular structure very much resembling two crow's nests placed with their faces or edges together, the dome or roof of the nest being somewhat thinner than the lower part. An irregular-shaped entrance-way is left at one side, and the walls of the nest support the dome-shaped roof at a sufficient height to permit the long tail of the sitting bird to extend upward, as the horizontal diameter is not sufficient to permit any other disposition of that member. Except in the lining, very coarse material is used in the construction of the nest—large twigs of cottonwood being most frequently used. The nest is roughly lined with finer twigs and strips of the inner bark of the cottonwood. A few of the nests we examined were newly made, but the majority were old nests which had been used in previous years. Quite a number of old deserted nests were found, particularly in the live oaks near this mouth of the cañon, where we found no recent nests at all. But a few years before a school-house had been built near this grove of oaks, and the "small boy" proved too much for even the magpies, who retreated up the cañon, leaving their tents behind them.

The eggs of the yellow-bill magpie vary considerably in color as well as in size and general shape. The description of the color given in Baird, Brewer and Ridgway, and copied by Mr. Oliver Davie in his "Egg Check-list of North American Birds," is applicable to nearly all the specimens I have seen, viz., "The ground-color is a light drab, so clearly marked with fine cloudings of an obscure lavender color as nearly to conceal the ground, and to give the egg the appearance of an almost violet-brown." One set of four in my collection has the lavender very pronounced, and in quite large spots or blotches, rather most numerous about the larger end. The eggs of this set measure 1.35 × .95, 1.43 × .90, 1.29 × .90 and 1.33 × .94—the average 1.35 × .89, being the largest of any of the sets I have seen. Another set of eight gives 1.18 × .85 as the smallest, 1.40 × .85 as the largest, and 1.30 × .85 as the average. The average of a set of six given by Mr. Davie is 1.30 × .89, and on another page he gives 1.20 × .92, presumably the average of many sets. B. B. & R. give 1.20 × .90 as the measurement of an egg from Monterey, Cal. These last measurements seem rather under the average of those I have seen.

Several of the nests to which we climbed were old deserted ones, and contained no eggs. Mr. Corey, after much difficulty, reached one in which he was surprised to find a set of eggs of the sparrow-hawk (*Tinnunculus sparverius*).

While we had been quite successful in securing many good sets of beautiful eggs, these material things alone did not represent the profits which the day had brought to us. During our morning ride, besides the objects already mentioned, we had seen, enjoyed and conversed about a score of other things no less attractive. And now in the evening, as the sun sank beyond the hills, and the highest peaks of the cañon's walls received its last warm glows ere it passed beyond the Pacific, new charms were added to the place. We saw the beautiful crested valley quails fly on whirring wing from the mesas and the chaparral to the dense foliage of the live oak, where their leader called to the night's repose; we heard the long-continued ringing note of the ground tit (*Chamæa fasciata*) from the thicket by the road-side; we heard —almost *felt*—the dismal, multitudinous barkings and howlings of a coyote that watched us from a ridge not far away, and could hardly believe one poor beast could carry on such a concert; we saw and heard and felt a hundred beauties which delight the soul and fill it with happy memories. We enjoyed most the fish we didn't catch.

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THE PHYLOGENY OF THE CAMELIDÆ.

BY E. D. COPE.

As is well known, the camels form a well-distinguished division of the Artiodactyla, or even-toed ungulates. The prominent features which separate them, osteologically speaking, from other Artiodactyla are three, viz., the absence of a canal of the cervical vertebræ which in other Mammalia encloses the vertebral artery (Fig. 1); the presence of an incisor tooth on each side of the

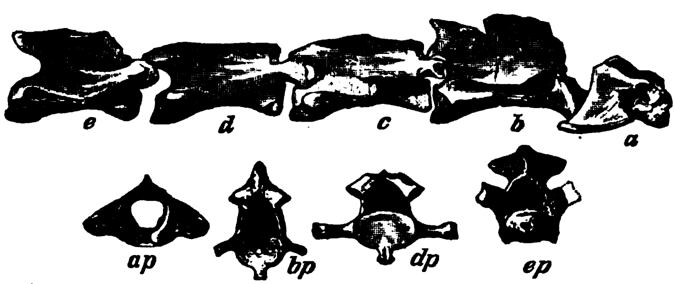

FIG. 1.—*Poëbrotherium labiatum* Cope; five anterior cervical vertebræ, showing absence of vertebrarterial canal; one-half natural size. Figs. *p*, posterior views of vertebræ lettered to correspond with those represented above them. Original, from specimen from White River bed of Colorado, represented in Fig. 7.

upper jaw (Fig. 12); and thirdly, the incompleteness of the keels of the distal ends of the metapodial bones (Fig. 2). This character and that of the presence of incisors, are primitive conditions common to all the early Mammalia. The peculiar cervical vertebræ constitute a specialization, but whether degenerative or progressive remains to be ascertained. In one respect this line exhibits a high specialization, which is present at the earliest known period of its history. This consists in the reduction of the lateral (II and V) metapodial bones, so that but two functional toes remain (see Fig. I, *c–f*). This condition has been reached by the more typical artiodactyles after a much longer lapse of time, for most of the extinct and recent types display lateral digits in a well-developed or rudimentary condition; in but few of them have they totally disappeared. In another respect the line of the camels attains a higher specialization than that of the typical ruminants, although its beginning is that which is common to the entire suborder. This is in the dentition. The reduction in numbers of teeth showed by Owen to characterize the historical succession of all Mammalia, is carried further in the molar series of camels than in any hoofed order; for in the final term or genus, Eschatius (Cope), there is but one premolar left in the upper jaw, and that is reduced to a simple cone. The true molars never reach the complexity of those of the other line, of the Bovidæ or oxen, nor do they become prismatic as in that family, but retain the short crown well distinguished from long roots, which belongs to all the earlier Mammalia.

The successional reduction in the numbers of premolar teeth in the family of the Camelidæ is shown in the following table.[1] There is seen in the genera Protauchenia and Palauchenia a tendency to an increase of complication of the fourth inferior premolar.

I. Premolar teeth $\frac{4}{4}$.

P-m. I separated by diastema.................................*Procamelus* Leidy.

II. Premolar teeth $\frac{4}{3}$.

P-m. II below wanting.......................................*Pliauchenia* Cope.

III. Premolar teeth $\frac{3}{2}$.

Fourth inferior premolar triangular..............................*Camelus* Linn.

Fourth inferior premolar composed of two crescents, which enclose a lake,(an inferior P-m. 3?)..................................*Palauchenia* Owen.

Fourth inferior premolar composed of two crescents, with two posterior tubercles behind them...................................*Protauchenia* Branco.

IV. Premolar teeth $\frac{2}{1}$.

Fourth premolar below triangular..............................*Auchenia* Illiger.

V. Premolar teeth $\frac{1}{1}$.

Fourth superior premolar composed of two crescents...........*Holomeniscus* Cope.

Fourth superior premolar consisting of a simple cone............*Eschatius* Cope.

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[1] From Proceedings Amer. Philosoph. Soc. 1884, p. 16.

The only genera which include existing species are Camelus and Auchenia, the camels and llamas respectively. It may be remarked that the latter genus, which is confined to the new world, is more specialized than Camelus, which is restricted to the old world.

FIG. 2. — Carpus, cannon bone and first phalanges of *Procamelus occidentalis* Leidy, from New Mexico, from individual Fig. 12; *a*, anterior, *b*, posterior views. Original, from Rept. U. S. G. G. Surv. W. of 100th mer., G. W. Wheeler.

Ancestral to the Camelidæ is the genus Protolabis Cope (Fig. 10), which agrees with Procamelus (Fig. 11), the earliest genus of that family in most respects, but differs decidedly in having a full set of superior incisor teeth. In this genus we reach the stage, in tracing back the ancestry of the camels, which we find represented by Oreodon in the series of the Chevrotains (Tragulidæ), or the Gelocus in the line of the cattle and deer. It is probable, though not certain, that in Protolabis the metapodial bones are combined into a cannon bone as in the Camelidæ. If so it differs materially from its predecessor, the genus Poëbrotherium, and must be regarded as the type of a special family, the Protolabididæ.

The Poëbrotheriidæ have their general characters like those of the Protolabididæ, but the metapodial bones are entirely distinct (Figs. 3, 7). The molar teeth are truly selenodont, and the crescents, as in the other families, are but four in number. The premolars are entirely different in form from the molars, and the last one in the upper jaw consists of but two crescents, as in ruminants generally.

The family which should be ancestral to the Poëbrotheriidæ is not certainly known. It should possess the foot-characters of the latter with quadritubercular inferior and superior molars. That is, instead of four crescents, these teeth should possess four cones or tubercles perhaps more or less flattened. Such forms are already known as ancestral to some other Ruminantia, as for instance the genus Anthracotherium, where the external cones are flattened on the outer side, or Dichobune, where the cones are not flattened at all. In both of these genera there are five tubercles to the superior molars, and the lateral (II, V) digits are present. We possess some fragments, however, of a lost genus from the age of the Poëbrotherium (the White River Miocene, or Oligocene), which very probably represents the one which fills the interval. This has been named Stibarus (Cope), and it is only known from parts of lower jaws which contain premolar teeth. These have a great resemblance to the corresponding parts of an older genus of the same line, Pantolestes, from the Wasatch formation or Lower Eocene. It might be suspected that Stibarus is a member of the Pantolestidæ but for one fact. The superior molars of Pantolestes belong to the primitive type which has only three tubercles or cusps. No genus of ungulate mammals having this character is known to pass the bounds of the Eocene series of epochs in any country, and it is extremely improbable that Stibarus will prove to be an exception to this rule. I have very little doubt that the superior molars will be found to be quadritubercular, but it is impossible to be certain whether the tubercles are simple or crescentic. The resemblance of the premolars to those of Pantolestes leaves the probabilities in favor of their being simple. In this case Stibarus represents a family in the wide interval between the Pantolestidæ and the Poëbrotheriidæ.

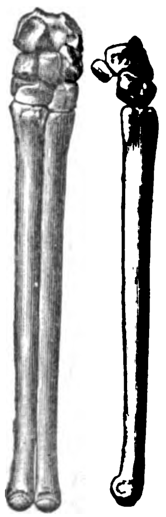

FIG. 3. — Carpus, metacarpus and end of cubitus of *Poëbrotherium vilsoni* Leidy. Original.

Messrs. Scott and Osborn have described a mammal, from the Bridger Eocene of Wyoming, as a probable member of the camel series, under the name of *Ithygrammodon cameloides*. It is only known from two premaxillary and a part of one maxillary bones. The former are slender and bear a complete set of incisor teeth, which are followed by a large canine. It is probable that this genus belongs in the camel series, but it cannot yet be positively affirmed.

The question of the origin of the Pantolestidæ is that of the origin of the suborder Artiodactyla. This I have believed would be found to have been from some yet undiscovered type or suborder of the order Amblypoda.[1] None of the known families of that order can have occupied this position, for although their general organization is appropriate, their superior and inferior molar teeth have been modified too much from the simple tritubercular type on which they are built. The ancestor of Pantolestes was an amblypod with the tubercles of its tritubercular superior molars entirely simple or conical. No such form has yet been discovered, but I have, in anticipation of such discovery, named the suborder the Hyodonta.

Dr. E. Schlosser in an abstract of an unpublished memoir to

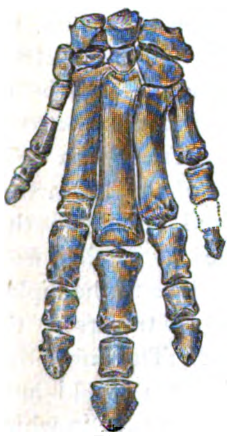

Fig. 4.

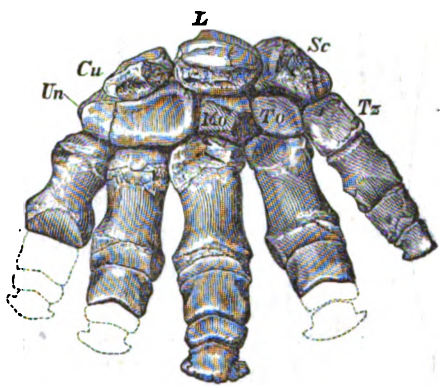

Fig. 5.

FIG. 4.—Left anterior foot of *Phenacodus primævus*, one-third natural size (original). FIG. 5.—Manus of Coryphodon (original). The cuneiform is imperfect. *Sc*, scaphoid; *L*, lunar; *Cu*, cuneiform; *Tz*, trapezium; *To*, trapezoides; *Mg*, magnum; *U*, unciform.

appear in the Morphologisches Jahrbuch,[2] takes the position that the Artiodactyla have been directly derived from the Taxeopoda and from the family of the Periptychidæ, thus leaving the Amblypoda out of their phylogeny. In this I cannot agree with him,[3] and for the following reasons:

The evolution of the Diplarthrous, or alternate wrist-and-ankle-boned Ungulata (Fig. 6), from the Taxeopoda, or straight-rowed wrist-and-ankle-boned Ungulata (Fig. 4), has been by the rotation

[1] Proceedings Amer. Philosoph. Society, 1882, p. 447. Report U. S. Geol. Survey Terrs., III, 1885, p. 382.
[2] Zoologischer Anzeiger, 1886, No. 222.
[3] On condition that the carpus of the Periptychidæ (which is unknown) is taxeopodous, as I have supposed.

inwards of the second row on the first, in both the fore and hind feet. This rotation has resulted sooner or later in the loss of the internal digit (thumb and great toe) from both extremities. In the history of this sliding inwards of the second row, the outside element of the row has always preceded in time the inside element. The Amblypoda (Fig. 5) show this clearly. The unciform bone has extended inwards so as to support the second bone of the first row (lunar) in part as well as the one which properly rests on it (cuneïform). But the magnum has not slipped inwards so as to support the scaphoid of the first row. That continues to be supported by its proper successors below, the trapezoïdes and the trapezium, the latter taking half the burthen. This structure (Fig. 5) is absolutely intermediate between that of the Taxeopoda (Fig. 4), and that of the Diplarthra (Fig. 6), and I imagine that all ungulates in passing from the taxeopodous to the diplarthrous stages traversed the amblypodous. The only other conceivable path would have been through a type in which the magnum had extended to below the scaphoid, while the unciform did not pass inwards beyond the limits of the cuneïform. No such type has been found. On the other hand, I have shown that the Oreodontidæ[1] have pushed the transposition of the bones of the second carpal row to such an extreme that the magnum has gotten entirely under the scaphoid, while the unciform supports the lunar completely. Thus the alternating position with its useful mechanical consequence has been lost to this group, the effect produced being exactly that seen in the Amblypoda. This may have had something to do with the extinction of the Oreodontidæ.

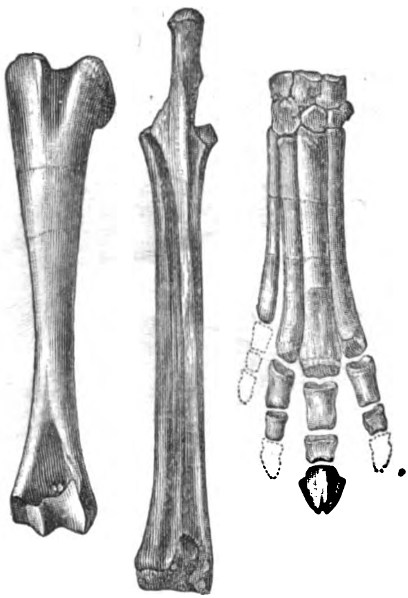

Fig. 6.—Fore-leg and foot of *Hyracotherium venticolum* Cope, two-thirds nat. size; from Eocene beds of Wind river, Wyoming. Original, from Report U. S. Geol. Surv. Terrs., III.

[1] Proceedings Amer. Philos. Soc. 1884, pp. 504–9, and 1884, p. 23 (Palæontolog. Bull., No. 39).

The following suggestions as to the origin of the three peculiarities of the cameloid series, or Tylopoda as they have been called, may be made. The imperfection of the distal metapodial keels (Figs. 2, 3 and 7) is probably due to the early development of an elastic pad of connective tissue beneath the proximal phalanges. It is this pad which gives the foot of the camel its peculiar lateral expansion, and causes its step to be both elastic and silent. This structure has relieved the metapodials of the concussions to which the feet of other Ruminantia are subject, and I have advanced this fact as the cause of the peculiarity of the metapodials above mentioned.[1] The cause of the absence of superior incisor teeth is unknown, but has been supposed to be complementary to the presence of horns in the Ruminantia. None of the camel line have horns, and the presence of the single incisor on each side may be connected with this fact; but why two of the incisors on each side should have been lost under the circumstances, is not explained. Nor has any explanation been offered for the absence of the vertebrarterial foramina of the cervical vertebræ (Fig. 1).

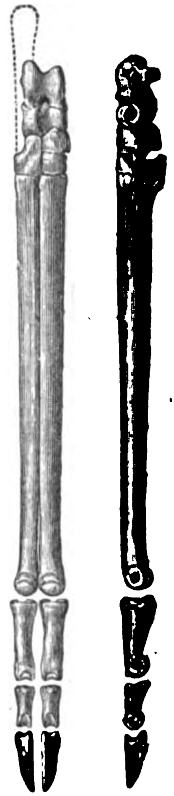

Fig. 7. — Hind foot of *Poëbrotherium labiatum* from specimen represented in Fig. 1. Original, from White River Miocene of Colorado.

There have been six species of the Pantolestidæ described, all belonging to the genus Pantolestes. The only ones of the six which are known from parts of the skeleton, are the *P. longicaudus* Cope, of the Bridger Eocene epoch, and the *P. brachystomus* of the Wasatch Eocene (Fig. 8). Neither of these species exceeded an existing musk-deer in size, and both had slender limbs. The tarsus of the *P. brachystomus* is known, and it is truly ruminant, though all the bones are distinct (Fig. 8). At the upper end the adjacent sides of the metatarsal bones are flattened and applied together, so that the later formation of a cannon bone by their fusion, must have been of easy accomplishment. The distal parts of these bones as seen in the *P. longicaudus* are not closely appressed, but are quite distinct from each other. The *P.*

[1] American Naturalist.

etsagicus, also from the Wasatch Eocene of the Big Horn river, is represented by a portion of a robust lower jaw as large as that of a fox.

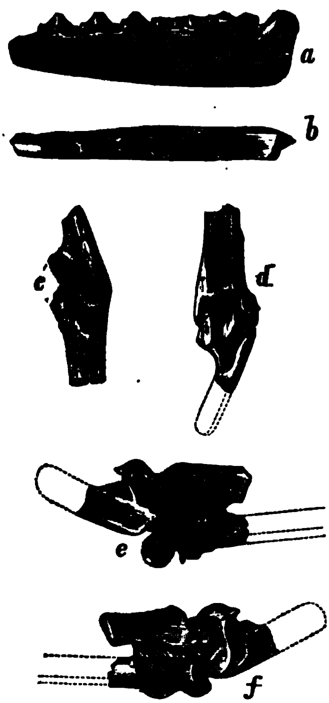

FIG. 8.—*Pantolestes brachystomus* Cope, nat. size, from Wasatch Eocene of Wyoming, Fig. *a*, superior molar teeth from below; *b*, mandible, left side; *c*, do. from above; *c*, tarsus with part of leg and metatarsus from before; *d*, from behind; *e*, from outside: *f*, from inside. Original, from Report U. S. Geol. Survey Terrs., Vol. III, F. V. Hayden.

But one species of Stibarus is known, and that from jaw fragments only in my museum and in that of Princeton College. These fragments appear to have belonged to an animal of the size of a pine weasel or martin, but the premolar teeth are very large for the size of the jaw and may indicate a larger animal. The anterior ones, ? first and second, have two roots each, and are quite elongate in the fore and aft direction. They are separated by a very narrow diastema from the tooth in front of them, ? the canine. The premolars are compressed and have a straight median cutting edge. This edge is thrown into two lobes between the anterior and posterior basal ones, the anterior only being the larger. The whole tooth resembles a rather low premolar tooth of a dog, and was evidently quite effective as a cutter of soft substances.

Of the Poëbrotheriidæ there are two genera. These differ as follows:

First premolar of upper jaw elongate and with two roots..... *Poëbrotherium* Leidy.
First upper premolar short and with a simple conic root..... *Gomphotherium* Cope.

In Poëbrotherium we have two species, a larger *P. labiatum* Cope, and a smaller *P. vilsoni* Leidy (Fig. 9). Both are animals of graceful and slender proportions, of about the size and build of the existing gazelles. Their heads were, however, of a more narrowed form towards the end of the muzzle. The remains of these animals have been found in the White River beds of Nebraska, Dakota, Wyoming and Colorado. They were evidently very abundant during Oligocene time.

The genus Gomphotherium embraces but one species, the *G.*

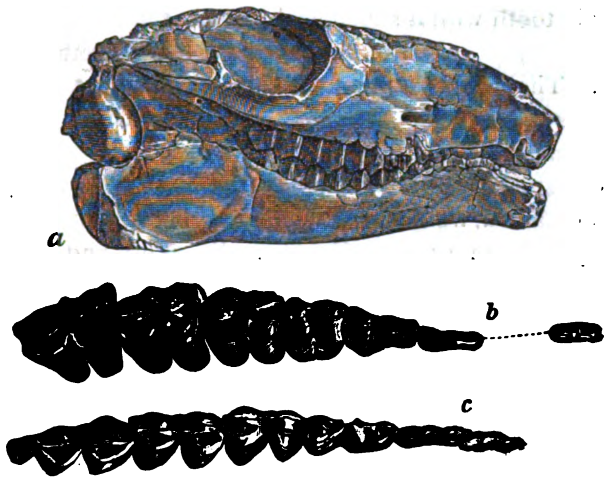

Fig. 9.—*Poëbrotherium vilsoni* Leidy, from White River Miocene of Nebraska. Fig. *a*, skull, right side, one-half natural size; *b*, superior molar teeth, nat. size; *c*, inferior molars, nat. size. From Leidy, Ancient Fauna of Nebraska.

sternbergi Cope, which was found by Mr. C. H. Sternberg in the John Day Miocene beds of Central Oregon. Its size exceeds that of either of the Poëbrotheria, equaling that of a llama.

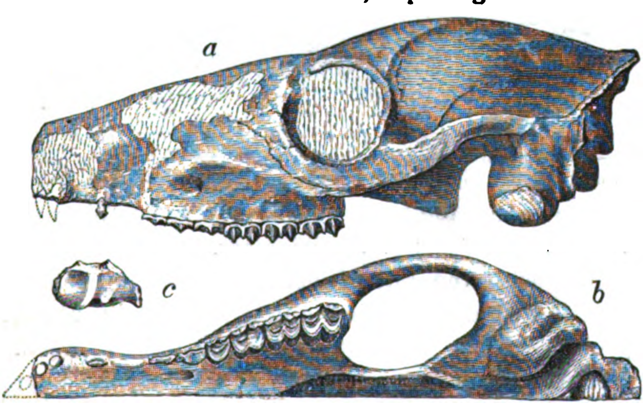

Fig. 10.—*Gomphotherium sternbergii* Cope, two-fifths nat. size, from the John Day Miocene of Oregon. Fig. *a*, left side; *b*, inferior side; *c*, distal end of radius. Original, from Report U. S. Geolog. Survey, F. V. Hayden.

Its limbs were also slender, and in their general characters resemble those of the genus which preceded it. The second and fifth digits are represented on both feet by small scale-like bones adherent to the sides of the two median metapodials. The inferior premolars in this genus are all much compressed, but differ much in form from those of Stibarus. The first upper premolar is a simple tooth with a subconical crown, totally different from the long cutting crown of the corresponding tooth in Poëbrotherium. The next two premolars alone are compressed, though the third is rather wide posteriorly. The fourth is like that of other ruminants.

The oldest species of Protolabis, *P. transmontanus* Cope (Fig. 11), was obtained from the Ticholeptus beds, which overlie the John Day beds in Central Oregon. Its skull and a few bones

a

b

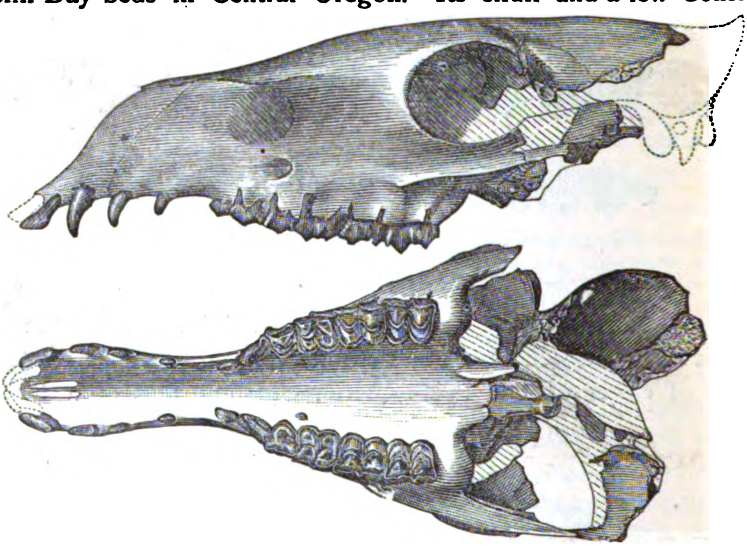

FIG. 11.—*Protolabis transmontanus* Cope, skull one-third nat. size, from Ticholeptus bed of Oregon. Fig. *a*, from left side; *b*, from below. Original.

only are known, but the former displays very complete dentition. Its size is about that of the Virginia deer. Its dimensions are in strict accord with the rate of increase of size to be observed in this series, and which it will be noticed, is maintained to the Pliocene epoch, when the greatest dimensions were attained. Two species of Protolabis appear in the succeeding or Loup Fork epoch which exceed the *P. transmontanus* in size. These are the *P. heterodontus* and the *P. prehensilis* Cope.

Accompanying the latter we have the species of Procamelus Leidy, the earliest members of the true Camelidæ. Its species vary in size from that of a sheep, as *P. gracilis* Leidy, to that of a deer, *P. occidentalis* Leidy, and to that of a camel, *P. robustus*

Leidy. The *P. occidentalis* (Fig. 12) appears to occur wherever the Loup Fork beds exist, from New Mexico north and east to Dakota. The *P. angustidens* Cope, intermediate in size between this form and the *P. robustus*, is not rare in Kansas and Colorado. Six or seven species of this genus have been named, one of them from teeth found near Richmond, Virginia. Species of the genus probably occur in beds of corresponding age in Florida.

Pliauchenia has been found as yet only in New Mexico, in two species not well preserved. It is not certain that any species of

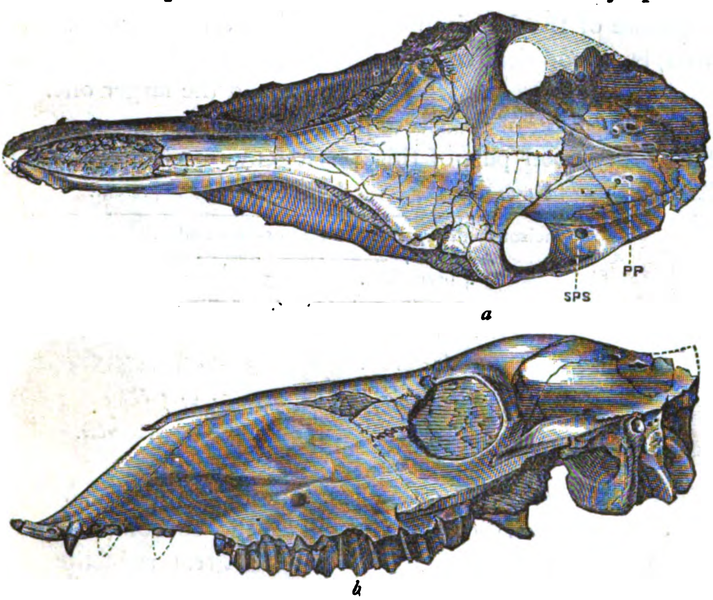

FIG. 12.—*Procamelus occidentalis* Leidy, one-third nat. size, from Loup Fork bed of New Mexico. Fig. *a*, skull from above; *b*, do. from left side. Original, from Report U. S. Expl. Surv. W. 100th mer., Vol. IV, G. M. Wheeler.

the genus Auchenia (llama) has been found fossil within the United States, though several have been described. Some or all of these belong to Holomeniscus Cope, which has only one premolar above, while Auchenia has two. A species about as large as a large llama has been found in the Oregon desert and named *H. vitakerianus* Cope. Another as large as the largest known camel is the *H. hesternus* Leidy. This fine species ranged from Oregon through California to the valley of Mexico, where it has been found by Professor Castillo of the School of Mines. A still larger species, perhaps of this genus, the *H. californicus* Leidy, must have exceeded in its dimensions either of the living camels. It is known from a few bones from California, and perhaps from Mexico.

The most specialized of all the genera of Camelidæ, Eschatius Cope, extended its range from Oregon to the valley of Mexico. I owe to the courtesy of my friend Dr. Mariano Barcena, formerly director of that department of the Museo National of the City of Mexico, the opportunity of inspecting specimens of the jaws and teeth of this genus. It is represented by two species. The larger, *E. conidens* Cope, was about as large as a camel or dromedary. It ranged from the valley of Mexico to Oregon; specimens found by Mr. Sternberg in the latter region not being distinguishable from those of the Mexican origin. The second species, *E. longirostris*, is a good deal smaller, and is only known from the same Equus beds of Oregon which have yielded the larger one.

The succession of structure in the leading genera of the selenodont or tylopod part of this phylogeny may be represented as follows:

	No cannon bone.	Cannon bone present.				
	Incisor teeth present.		Incisors one and two wanting.			
	4 premolars.			3 prem's.[1]	2 prem's.	1 prem'r.
Lower Miocene	*Poëbrotherium.*					
Upper Miocene		*Protolabis.*	*Procamelus.*	*Pliauchenia.*		
Pliocene and recent					*Camelus.*	*Auchenia.*

This table shows that geological time has witnessed, in the history of the Camelidæ, the consolidation of the bones of the feet and a great reduction in the numbers of the incisor and premolar teeth. The embryonic history of these parts is as follows: In the fœtal state all the Ruminantia (to which the camels belong) have the cannon bones divided as in Poëbrotherium; they exhibit also incisor teeth, as in that genus and Protolabis. Very young recent camels have the additional premolar of Pliauchenia. They shed this tooth at an early period, but very rarely a camel is found in which the tooth persists. The anterior premolar of the normal Camelus is in like manner found in the young llama (Auchenia), but is shed long before the animal attains maturity. I may add that in some species of Procamelus caducous scales of enamel and dentine in shallow cavities represent the incisive dentition of Protolabis.

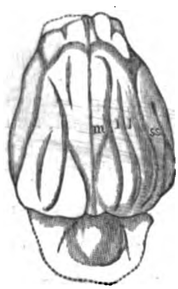

FIG. 13.—Cast of brain of Poëbrotherium, one-half nat. size. From Bruce, in Bulletin of E. M. Museum, Princeton, N. J.

[1] In lower jaw.

In greater detail, the extinct American forms of this line are distributed as follows:

	Eocene.		Miocene.				Pliocene.
	Wasatch.	Bridger.	White River.	John Day.	Ticholeptus.	Loup Fork.	Equus.
Pantolestes Cope	5	1					
Ithygrammodon S. O.		1					
? Stibarus Cope			1				
Poëbrotherium Leidy			2				
Gomphotherium Cope				1			
Protolabis Cope					1	2	
Procamelus Leidy						6	
Pliauchenia Cope						2	
Holmeniscus Cope							3
Eschatius Cope							2

The total number of genera, nine; of species, twenty-six.

The development of the brain displays the same progress that has been shown by Lartet and Marsh to have taken place in other lines of Mammalia. The accompanying figures of the brain, show that while the *Procamelus occidentalis* is inferior to the camel in the size and development of the convolutions of the hemispheres, it is in advance of the *Poëbrotherium vilsoni* in these respects (Figs. 13–14).

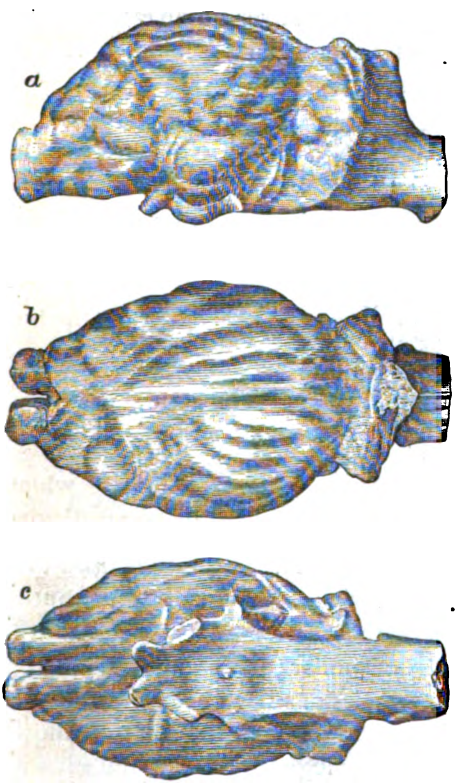

Fig. 14.—*Procamelus occidentalis*, cast of brain from skull represented in Fig. 12, one-half nat. size. Original, from Report U. S. G. G. Surv. W. of 100th mer., 1877, Vol. IV, G. M. Wheeler.

The development of the camels in North America presents a remarkable parallel to that of the horses. The ancestors of both lines appear together in the Wasatch or lowest Eocene, and the successive forms develop side by side in all the succeeding formations. Camels and horses are standard types in all our Tertiary formations; and they must be learned by any one who wishes to distinguish readily the horizons one from the other. The horse-forms are more numerous in all the beds, in individuals as well as in species. Both lines died out in North America, and of the two, the camels only have certainly held their own in South America. The history of the succession of horses in Europe, although not as complete as that in America, extends over as wide a period of time. Not so with the camels. There is no evidence of the existence of the camel line in the old world prior to the late Miocene epoch; and so far as the existing evidence goes, the new world furnished the camel to the old.

Camelidæ only appear in South American palæontology in the genus Auchenia, in Pliocene time, in the Pampean beds. The best known species are *Auchenia weddellii* and *A. intermedia* of Gervais. It is curious that M. Ameghino, in his report on the fauna of the Miocene age found on the River Parana, which contains the ancestors of so many Pliocene genera, finds none that stand in that relation to these llamas.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

—— Various suggestions have been made as to the permanent organization of science at the National Capital. The necessity for the employment of experts having been felt in various departments of the Government, commissions and offices for the conduct of research have grown up in them. The results have been greatly to the advantage of the Government and of the people, and have often represented important advances of science itself. The efficiency of these commissions has, however, often been impaired through their association with the various bureaus and departments under which they are placed. This comes from their necessary direction by non-experts and the quantity of routine work which may be required of them. There is also necessarily more or less overlapping of the similar offices in the different departments. Many of the commissions have been from time to time threatened with total extinction through the want of knowledge of their utility by some of our legislators. Several illustrations of this fact have recently occurred in Washington. The able superintendent of the Coast Survey has been removed, and his place taken by superior clerk of the Treasury Department.

A bill has been introduced into the House of Representatives by Mr. Herbert, of Alabama, which forbids the publication of its results by the Geological Survey, which, with other restrictions, is almost equivalent to its abolition.

On the other hand a bill has been introduced by Mr. Reagan, of Texas, creating a "Department of Industries," to be represented in the Cabinet. This bill contemplates combining in the new department the following divisions: Agriculture, Labor and Commerce. The division Agriculture embraces the subdivisions: 1. Agricultural products, including botany, entomology and chemistry; 2. Animal industry; 3. Lands, including the geological survey.

As regards the intrinsic merits of this proposed new department we have nothing to say, but we think there are better ways of disposing of the scientific work of the Government. The above plan omits necessarily a number of important scientific bureaus, and does not provide for the consolidation of all the offices which pursue a given branch of science. Thus there will be a chemical commission in the Agricultural Department and another in connection with the Navy, as at present, and so on.

If it can be done properly, the creation of an organization to be called the Department or Bureau of Science and Public Instruction, to be embraced in the present Department of the Interior, might meet the necessities of the case. Such a department would embrace the present Naval Observatory, Nautical Almanac, Signal Service, Coast Survey, Fish Commission, Geological Survey, Agricultural Department, Bureau of Statistics and Bureau of Education. The diverse and heterogeneous character of the above divisions might be remedied by a suitable re-classification.

Each of the divisions should be under a capable expert, who should devote his time to promoting the efficiency of the work. Financial matters to be under direct management and control of the head of the entire bureau.

But the essential to success of this or of any other plan for promoting science at Washington is that its offices be removed from the field of political patronage. How this is to be done is the question. The Smithsonian Institution as a private corporation, and the National Museum as under its direction, are happily removed from such contingency, and any system which would place the scientific commissions and bureaus in a position of equal security, would be a great benefit to them. Nothing would be gained in this direction by the creation of the proposed new department. For this reason the commission appointed by Congress to investigate the relations of the scientific bureaus to each other and to the Government has decided that no change of organization should be made at present.

RECENT LITERATURE.

GILBERT'S TOPOGRAPHIC FEATURES OF LAKE SHORES.—This treatise is reprinted from the fifth annual report of the director of the U. S. Geological Survey, and is based on the observations of many years, particularly in Utah, around the shores of Great Salt lake. The author states that the body of the essay was prepared before he met with the writings of Elie de Beaumont and of Cialdi. It is well illustrated with original diagrams and land-

FIG. 1.—Sheep Rock, a sea-cliff on the shore of Great Salt Lake, near the Black Rock bathing resort.

scape illustrations, some of which we have been permitted to use.

After discussing the subject of earth-shaping, a second section treats of littoral erosion. While the impact of large waves has great force and its statement in tons to the square foot is most impressive, the author believes, as the result of his own observations, that "the erosive action of waves of clear water beating upon firm rock is practically nil. It rarely happens, however,

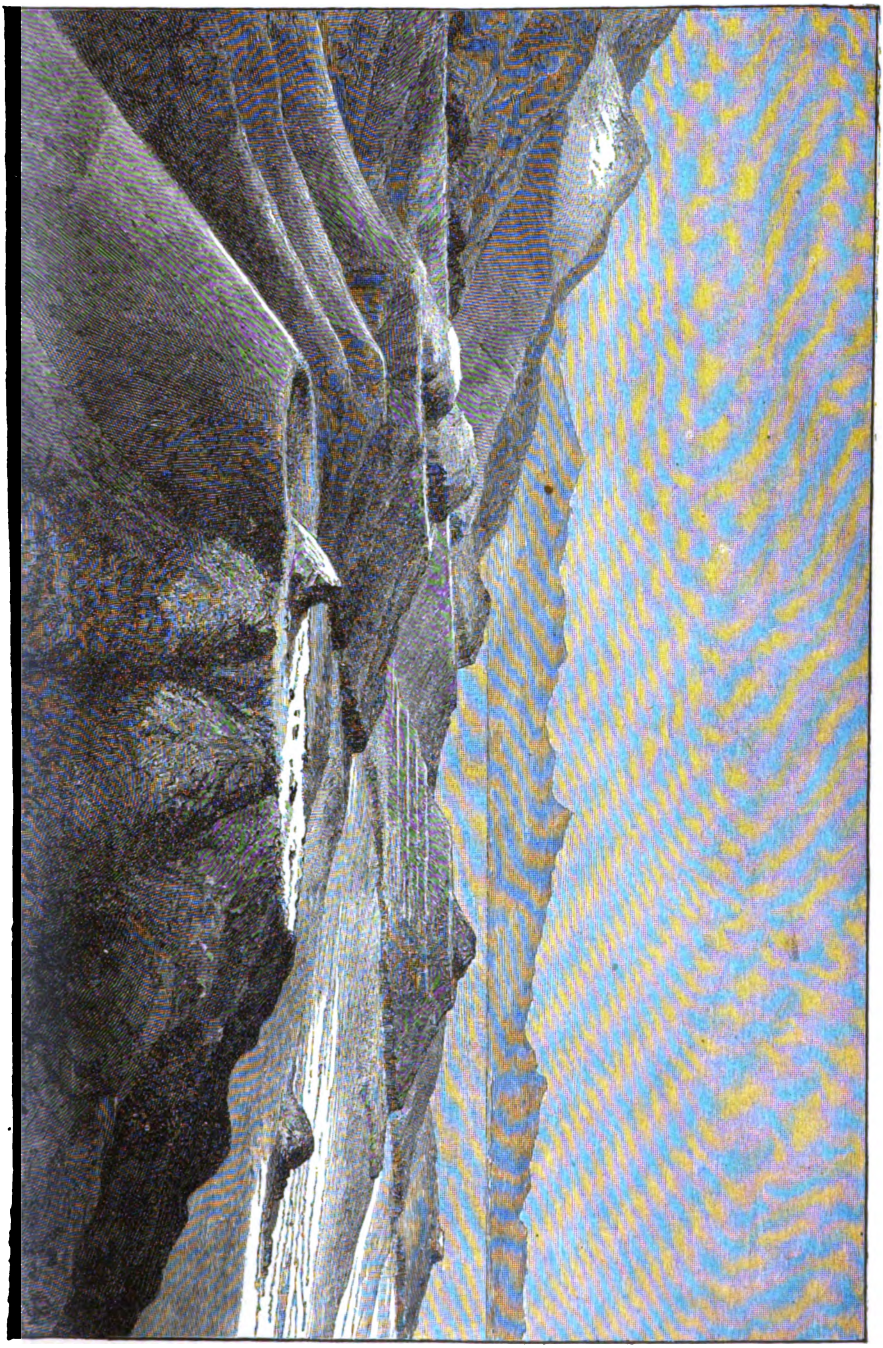
PLATE XXV.

Ancient Sea-cliff in boulder clay, South Manitou Island, Lake Michigan.

PLATE XXVI.

Bird's-eye view of Madison Valley, Montana, showing stream terraces.

PLATE XXVII.



that the impact of waves is not reinforced by the impact of mineral matter borne by them. The detritus worn from the shore is, of course, always at hand to be used by the waves in continuance of the attack; and to this is added other detritus carried along the shore."

The sea cliff and wave-cut terrace are then described and well illustrated; then follow the discussion of littoral transportation, the beach and the barrier. Under the last head the following remarks on the part played by great floods and storms will interest our readers:

"Not only is it true that the work accomplished in a few days

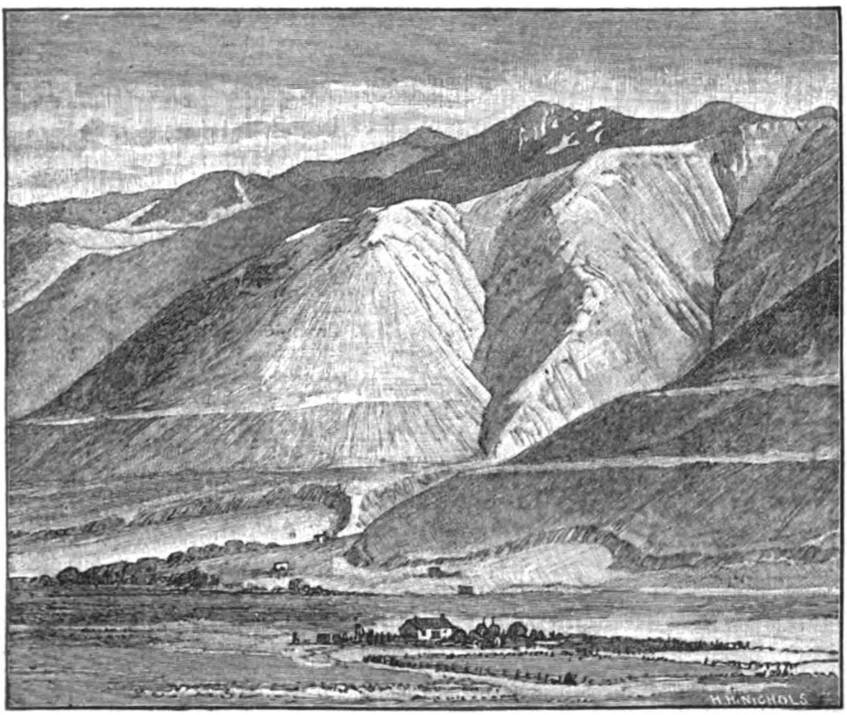


FIG. 2.—Fault scarps and shore lines at the base of the Wasatch.

during the height of the chief flood of the year is greater than all that is accomplished during the remainder of the year, but it may even be true that the effect of the maximum flood of the decade or generation or century surpasses the combined effects of all minor floods. It follows that the dimensions of the channel are established by the great flood and adjusted to its needs.

"In littoral transportation the great storm bears the same relation to the minor storm and to the fair-weather breeze. The waves created by the great storm not only lift more detritus from each unit of the littoral zone, but they act upon a broader zone and they are competent to move larger masses."

Under the head of littoral deposition the origin of embankments, spits, bars, hooks, loops, wave-built terraces, V-terraces, V-bars and of dunes is discussed.

The third section is devoted to the distribution of wave-wrought shore features; a fourth section to stream work and deltas. In a fifth section ice work and shore walls on lakes are described. After referring briefly in section six to the effects of submergence and emergence on the phenomena under consideration, attention is called in the seventh section to the discrimination of shore features, under the head of cliffs, fault scarps, terraces, fault terraces, etc., and ridges, the latter being contrasted with moraines and osars. Fig. 2 gives a good idea of the remarkable fault-scarps at Farmington, Utah. The eighth and last section relates to the recognition of ancient shores.

The essay is upon a subject of very general interest, every geologist having his attention drawn to the phenomena which the author explains. A similar work based on sea-shores would be of still wider interest and importance, though some attention is given to the subject in our leading text-books on geology.

Recent Books and Pamphlets.

Noetling, — .—Descriptions of three species of fossil fishes of the genera Ginglymostoma, Odontaspis and Squatina. Ext. Proc. Gesell. naturforschender Freunde., Feb., 1886. From the author.

Putnam, C. E.—Elephant pipes and inscribed tablets in the Museum of Davenport, Iowa. 1886. From the author.

Dugès, E.—Métamorphoses d'une Corydalis. Ext. du Bull. d. l. Soc. Zool. de France, 1885.

Foote, A. E.—Regla Basalt and el Chico. Naturalist's Leisure Hour, April, 1886. From the author.

Frazer, P.—The work of the International Congress of Geologists and its Committees 1886.

——A new application of the principle of composite photography to the identification of handwriting. Rep. Jour. Franklin Inst., 1886. Both from the author.

Walling, H. F.—Topographic surveys of States. Read bef. Boston Soc. Civil Eng., Feb., 1886. From the author.

Roger, O.—Kleine paläontologische Mittheilungen. From the author.

Renevier, E.—Resultats scientifiques du Congrès Géologique international de Berlin. Lausanne, 1886. From the author.

Van Beneden, P. J.—Les Cétacés des mers d'Europe. Bruxelles, 1885. From the author.

Winchell, A.—Science and the State. Rep. from "The Forum."

——Sources of trend and crustal surplusage in mountain structure. Ext. Proc. Amer. Assoc. Adv. Sci., Vol. XXXIV, 1885.

——Ditto ditto from the Amer. Jour. Science.

——Thoughts on science teaching. From the Fortnightly Index, July 12, 1884. All from the author.

Boulenger, G. A.—A reply to M. de Batta's Remarks on *Rana temporaria*. Ann. and Mag. Nat. Hist., 1886.

——Description of a new frog of the genus Megalophrys. Ext. Proc. Zool. Soc., 1885. Both from the author.

Shufeldt, R. W.—Outlines for a museum of anatomy. Department of the Interior, Washington, 1885.

——The skeleton of Geococcyx. From the Journal of Anatomy and Physiology, London, Jan., 1886. Both from the author.

Scudder, S. H.—Nomenclator Zoölogicus. Bull. U. S. National Museum, No. 19, Washington, 1882–1884.

——Systematische Uebersicht der fossilen Myriopoden, Arachnoiden und Insekten. 1885. Both from the author.

Lydekker, R.—Catalogue of the fossil Mammalia in the British Museum. Part II. Ungulata Artiodactyla. London, 1885.

——On the occurrence of the crocodilian genus Tomistoma in theMiocene of Malta.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

ASIA.—*Tong-king.*—The April number of the Proceedings of the Royal Geographical Society contains a map of Tong-king, accompanied by an article upon the hill region which lies beyond the delta of the Song-coi. The writer (Mr. I. G. Scott) states that though the Song-coi is a noble-looking river, boats drawing over fifteen feet cannot ascend its Cua Cam mouth to Haiphong, while boats drawing six feet have difficulty in reaching Ha-noi. There are four principal mouths, of which the Cua Cam is the most northern, but it seems probable that the Cua Dai (the most southern) will shortly be made use of for deep-sea ships. The provinces of Kwung-yen, Lang-son, Cao-bang, Thai-nguyen and Tuyen-kwan form the plateau region, north of the Song-coi delta. This is a land of rounded, grassy hills, without prominent peaks.

The delta is rapidly extending. When Ha-noi was built by the Chinese in the eighth century, it was a sea-port, but is now a hundred miles inland. Two centuries ago Hung-yen was on the coast, and was the site of the Dutch and Portuguese factories. It is now thirty miles inland. Our author declares that Lang-son is, geographically and ethnographically, Chinese. It is on the Chinese slope and is separated from the rest of Tong-king by a barren mountain belt fifty miles in width. Some remarkable cave-temples exist near the town.

The Survey of Japan.—During the last five years the National Survey of Japan has been steadily progressing under the superintendence of Dr. Naumann, who has now left the task to be carried out by the Japanese he has trained. An account of the work performed may be found in *Nature* (April 29th, 1886). The survey was based mainly on economical considerations, and started with topographical, geological and agronomical departments. A chemical section was added. The existence of Devonian, Carboniferous, Triassic, Jurassic, Cretaceous and Tertiary rocks was

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

proved by well-characterized fossils. Radiolarian slates, probably older than the Carboniferous limestone, occur in almost every part of the archipelago. The Japanese island chain is one of the finest examples of a mountain range of unilateral structure.

Asiatic News.—The Russian Trans-Caspian railway was by the end of last year opened as far as Ghiaurs. From this spot to Merv the necessary earthworks were completed. From thence to Chardjui, 118 miles from Merv, the route will be across desert. It is proposed to prevent the access of moving sand by plantations along the line.——An ethnographical map of Asia, six and a half feet by four and a half feet, showing the localities of 136 divisions of peoples and languages, in twenty-six tints of color and shading, has been made by Herr Vincent von Haardt, of Vienna.——A recent issue of *China Review* contains an article, by Mr. C. Taylor, upon the aborigines of Formosa. Mr. Taylor has resided four years in the south of the island, and his information regarding the Paiwans, or people of this part, is therefore derived from intimate observation. He is also acquainted with the Ameirs, who have scattered themselves in small villages along the east coast down to South Cape. With the Pipohuans, or half-castes of the plains, and the Tipuns, he is only acquainted through information obtained from stragglers domiciled among the Paiwans. ——The report of Mr. G. Schumacher, published by the Committee of the Palestine Exploration Fund, is full of interesting details upon the Jaulan and Hauran regions. The river Yarmuk, whose course marks the southern limit of the Jaulan basaltic region, receives from the north several tributaries, which are here for the first time correctly mapped. The Rukhad, one of these, rises at the foot of Mt. Hermon (Jebel-esh-Sheikh). Its tributary, the Wady Seisun, falls 517 feet in 420 yards by a succession of cataracts. These rivers have their sources in springs, and there are clear indications of the existence of large reservoirs of underground water in the basaltic and calcareous formations.

ASIATIC ISLANDS AND AUSTRALIA, ETC.—Barren and Narcoudam, two volcanic islands belonging to the Andaman archipelago, and lying east of the main islands, have been surveyed by Capt. Holday, of the Indian Survey. Barren island is circular, about two miles across, and its principal features are a main crater, with axes of one and a half miles and one mile, and an inner cone about half a mile across at its base and rising 1015 feet above the sea. The inner cone bears upon its summit a small crater from which steam and smoke issue. The volcano is known to have been active towards the end of last century.

Narcoudam is about two and a half miles in length and half as broad. It rises 2330 feet above the sea, and is composed of trachytic lava, but no trace of any crater was discovered. The slopes are covered with dense forest, but no water was found.

Mr. E. W. Birch has recently visited and reported upon the Keeling or Cocos islands. These islands, over twenty in number, very narrow and thickly planted with cocoa palms, surround a lagoon for the most part shallow. The island is evidently rising. The islands are administered by an English family named Ross, and have a Malay population of more than 500. The temperature is wonderfully equable, varying in a year only from 72° in September to 84° in April.

Mr. Winnecke asserts, as in 1877, that Lake Eyre is a considerable depth below sea-level. The highest point along his survey of the route of the overland telegraph was the Burt plains, 2532 feet above sea-level; but the MacDonnell ranges, in which these plains are situated, rise several thousand feet higher. The Finke river, the southern part of which is now being reëxplored by Mr. Lindsay, is described as the largest and most important in Central Australia.

The population of the Sandwich islands has increased from 57,985 in 1878 to 80,578 in 1884, yet in that time the native race has diminished from 44,088 to 40,014. The census of 1884 gave 17,932 Chinese, 9377 Portuguese, 2066 Americans, 1282 British, and 1600 Germans; the previous numbers (1878) being 5916, 436, 1276, 883 and 272 respectively.

A new atlas of the Dutch East Indies has been published at the Hague. It contains a map of the entire archipelago, four maps of Java and Madura, giving population, roads, etc.; maps of parts of Java to a still larger scale, and others of Banka, Billiton, Borneo, Celebes, Sumbawa, Timor, the Moluccas, etc.

EUROPE.—*European News.*—From the observations of E. von Meydell, extending over a period of eight to ten years, it appears that the waters of the Black sea are subject to slight variations of level dependent upon the amount of water brought down by the Danube, Don, etc. The maximum, nine to seventeen centimeters above mean water-level, is attained in May and June, and is highest in those years in which the rainfall in Central and Southern Russia is greatest.——New and more precise levelings to ascertain the heights above the sea of Lakes Ladoga, Onega and Ilmen (Russia) place them at 16, 115 and 59 feet respectively; instead of, as before believed, 59, 237 and 157 feet.——The population of Prussia (not the German Empire), according to the census of December 1, 1885, was 28,314,032. In 1880 it was 27,279,111.——"The highest peak in Denmark" is a hill in the forest of Ky, 163 meters in height.

AMERICA.—*American News.*—A Swiss named Rodt has founded a flourishing colony in Juan Fernandez, which he leases from Chili. Not only agriculture, but manufacturing industries are practiced. The colonists comprise members of most civilized nationalities, except Prussians, who are excluded.——In the January issue of the *Revue Geographique*, M. H. Condreau gives an account of the manners of the Uapes. Most of the tribes of the river border have no garment whatever, but in some tribes the men wear a "calembe" of bark, and in the villages lower down the river the men don pantaloons and the women a chemise when they are full-dressed. Some tribes still inter their dead in the "maloca," or hut, which the Tucanas immediately abandon in order to build another.——M. Thouar reports as the result of his last journey to the rapids of the Pilcomayo, that it is possible at any season of the year to go from the mouth of that river at Lamboné to the mission of San Francisco de Solano, in Bolivia, at the very foot of the Andes. The difficulties caused by accumulations of trees and the consequent formation of shallows can, he believes, be overcome.

Africa.—*African News.*—The missionaries sent out by the Basel Missionary Society to the Gold coast have, since 1882, explored the Volta basin pretty thoroughly, and the geographical results obtained have been considerable. A map of the routes is published in the April number of the Proc. Roy. Geog. Society.——Lieutenants Kund and Tappenbeck struck southward from Stanley pool in August last, returning to Leopoldville on January 27th. They crossed the Quango, also the Bolombo or Sankuru and its affluents, and descended the Lukenje to Kwamouth. It is stated that they have discovered a new river, the Ikata, which M. Wauters believes to be the upper course of the Mfini.——The Bulletin of the Soc. Roy. de Geog. d'Anvers contains an interesting account of an exploration upon the Senegal, from Futa-Djallon to Bambouc, undertaken by M. E. Noirot, who seems everywhere to have met with a good reception, and who is enthusiastic respecting the productions and future commerce of the Senegal basin.——The murder of the young and enterprising French traveler, Palat, at two days' distance from Insalah, is alleged to be due to the Senonsian fraternity. On the other hand, French journals are disposed to lay much of the blame upon the French commandant, whose treatment of the adventurous young lieutenant was such as to make the Arabs believe him to be in disfavor with his own people.——The members of an expedition sent out by the Geographical Society of Milan have been massacred by the Emir of Harrar. Count Porro, the leader, Professor Sicata, and seven others were killed.——M. Barral and his wife, who set out from Obock to explore Abyssinia, with the object of establishing commercial relations, were murdered by the Danakils on the borders of Shoa.——Mr. R. Baron communicates to *Nature* some valuable notes upon the volcanic phenomena of Central Madagascar. In this part there are many extinct volcanic cones, especially in two localities situated, the one fifty to sixty miles west, the other seventy to eighty miles southwest of Antananarivo.

They are scoria cones, none of them probably rising more than 1000 feet above their base. Many have breached craters, whence floods of black basaltic lava have flowed. The almost perfect state of preservation of the cones and the undecomposed condition of the lava proves that these volcanoes must have been active in comparatively recent times.——Scarcely a year passes without one or more earthquake shocks in Central Madagascar, but they are never severe nor of long duration.——Cardinal Massaja has published at Rome a work entitled "My thirty-five mission years in Upper Ethiopia." Numerous illustrations and a good map accompany the text.

GEOLOGY AND PALÆONTOLOGY.

THE FOSSIL MAN OF PEÑON, MEXICO.—On my return to this city after a long absence, I read the observations published in the *New York Tribune* concerning my account of the fossil man of the Peñon.

It will give me great pleasure to clear up the doubt expressed by Professor Newberry with regard to the importance of the discovery of the man of the Peñon.

Professor Newberry does not believe in the importance of the discovery, and argues in this manner: "The calcareous bed in which the fossil remains were found must have been modern travertin; it could not have been deposited below the waters of a lake, but probably belongs to an aërial or superficial formation, since otherwise it would be of equal thickness and uniform on the bottom and on the borders of the lake; if the limestone is siliceous, it must belong to a hydrothermal deposit."

It is above all certain that the limestone is not modern travertin, for it does not form concentric layers above the human remains, nor over other recent objects, as would be the case were it such. The bones are sealed up, so to speak, in the calcareous rock, without being in any way coated, and were probably deposited while the rock was yet soft and under water. As the clearances and excavations at the foot of the small mountain of Peñon have been continued, I have been able to prove the persistence of the facts indicated in my article published in the NATURALIST, August, 1885, as well as in a fuller account of the same subject published in 1884 by Professor Antonio del Castillo and by me.

The new excavations have shown more clearly yet the three formations of which I have spoken, ranged as follows:

(1) A superficial layer 10 centimeters thick, formed of vegetable earth, containing lacustrine shells and fragments of modern pottery.

(2) A layer of calcareo-siliceous tufa, of but slight hardness, with remains of old pottery, 50 centimeters thick.

(3) Siliceous limestone, very hard, in a thick bed, inclined towards the north. Here are found roots transformed into *men-*

ilite and lacustrine shells. It is in this bed that human remains, and no others, have been found. The thickness of this bed is not yet known, as it has only been opened to a depth of $1.2^{m.}$ The bed is covered by a thin layer of a limestone richer in quartz, a true ribbon, dividing the adjacent formations.

Not a single modern object has been found in this bed, nor in another similar one situated to the south of the mountain, more than a meter thick, and resting on a lacustrine and turfy formation.

Two miles northwest of Peñon there is another bed of siliceous limestone at the foot of the mountain chain of Guadalupe, and stretching over a great length. This limestone is in composition, appearance and position, identical with that of Peñon, containing roots transformed into menillite, and in its upper part fragments of old pottery. What is most important in this formation *is the existence of elephant bones sealed in the hardest bed, like that of Peñon.* These bones have been taken out on many occasions. I have done it myself in the presence of the professors of the National Museum.

The distance from this bed to that of Peñon is so inconsiderable, and the circumstances and physical character are so similar, that this bed and that of Peñon can be considered as belonging to the same geological horizon, so long as no object indicating a different horizon is found in the latter. Meanwhile all our observations induce us to believe in the contemporaneity of the man of Peñon and of the mammoth in the valley of Mexico.

I must now show why, according to my belief, the limestone of Peñon was once engulfed below the waters of the lake. In the first place, it is evident that the bed has been raised and tilted, so as to occupy a position different from its primitive one, and, the Peñon having for an enormous number of years been surrounded by water, we must believe that the calcareous bed, which is now three meters above the level of the lake, was covered with water during the same interval. Besides, it contains the shells of Paludina and other aquatic species, and this dissipates all remaining doubt of its former position beneath the waters of the lake.

Professor Newberry is correct in remarking that it is very rarely that lime, which in the first instance is dissolved in water in the state of carbonate, is not precipitated so as to form a uniform bed over the bottom of the lake. This is the ordinary case, and what might be expected; but the deposit has only been observed in isolated masses, and the peculiarity can be explained by supposing that the bed has been buried deeply below its actual surface and covered by the modern deposits of the lake in many places, though this cannot yet be stated as a proved fact. The hydrothermal origin, which I have attributed to the limestone in the article in the NATURALIST, has been proved by later observations, for in many fissures of the Peñon rock thin veins are found composed of calcareous matter in some cases, of siliceous in others. Besides, upon the summit of the Guadalupe mountains occur masses of shell-rock (*masses lavignes*) impregnated with siliceous limestone, which demonstrates their contemporary origin. What hinders me from believing that the existing hydrothermal springs at the foot of the Peñon can be the origin of the formation which surrounds the mountain is that these springs form only isolated and insignificant deposits, which cannot spread out uniformly like the limestone beds; at most they could form accumulations like those of which Professor Newberry speaks, and which are characteristic of geysers. The above-mentioned springs were probably the last traces of the abundant eruptions of calcareo-siliceous waters which formerly shot forth at the same time with lava, as at Peñon and at many other points in the valley of Mexico. The superficial revetements are caused by the solution and precipitation of the materials which cover the upper rocks, of the veins, or of the alteration of the basalts of the mountain. We must, therefore, believe in the importance of the discovery of the man of the Peñon.

No one can be more anxious than I to base these discoveries upon clear and well-determined facts, as I stated in my article in the NATURALIST. Professor Castillo and myself have assiduously studied the Peñon formations, and with the sincerity which scientific truth exacts we will inform the learned world of later discoveries. If it should happen that in the rocky tomb of the man of the Peñon the remains of his primitive weapons or the iron of his conqueror should be found, we shall doubtless be the first to announce it.—*Mariano Barcena.*

ON THE FOSSIL FLORA OF THE LARAMIE SERIES OF WESTERN CANADA.[1]—The Laramie series, formerly known as the Lignite Tertiary or Lignitic group, occurs in Canada, principally in two large areas west of the 100th meridian and east of the Rocky mountains, and stretching northward from the United States boundary. These areas are separated from each other by a low anticlinal of Cretaceous beds, over which the Laramie may have extended previously to the later denudation of the region.

These areas may be designated—(1) The Eastern or Souris River and Wood Mountain area; (2) the Western area, extending along the eastern side of the Rocky mountains and across the upper waters of the Bow, Red Deer, Battle and North Saskatchewan rivers.

In the southern part of the district of Alberta it has been found possible to divide the Laramie into three parts, which have been named respectively, in the Reports of the Geological Survey of Canada, (1) the lower or St. Mary River division, (2) the middle or Willow Creek division, and (3) the upper or Porcupine

1 Abstract of a paper read before the Royal Society of Canada, May, 1886, by Sir William Dawson, LL.D., F.R.S.

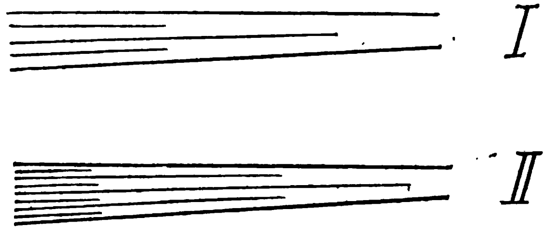
Hill division. Of these the lower and upper contain fossil plants, more especially the latter, and corresponding horizons can be recognized by these in both of the great areas above referred to. The flora of the lower division has a close alliance with that of the Belly River group of the underlying Cretaceous, while that of the upper division is in the main identical with that of the Fort Union group of the United States geologists, as described by Newberry and Lesquereux.

In the Eastern area the lower beds of the Laramie rest on the Fox Hill group of the Cretaceous, and are in turn unconformably overlaid in the Cypress hills by beds referred, by Professor Cope on the evidence of mammalian remains, to the White River division of the Miocene Tertiary. Thus the geological horizon of the Laramie is fixed by its stratigraphical relations as between the Upper Cretaceous and Lower Miocene formations. The evidence of fossil remains accords with this position. The Lower Laramie has afforded reptilian remains of Mesozoic aspect, associated with fishes and mollusks, some of which are of Eocene types, according to Cope and Whiteaves, and its flora is akin to that of the Upper Cretaceous. The Upper Laramie has afforded a flora so modern in aspect that it has even been regarded as Miocene, though in reality not later in age than the Eocene. The Willow Creek or Middle Laramie division may therefore (as suggested by the author in his memoir of last year on the Western Cretaceous) be regarded as the transition from the Cretaceous to the Eocene.

The question of the correlation of the Laramie with other formations has been much complicated by the reference in the United States and elsewhere, of beds holding its flora to the Miocene period, and these difficulties cannot as yet be wholly overcome, though they are gradually being removed. In Canada, since the plants began to be collected and studied, there has been little doubt on the subject, and the author now, as heretofore, holds to the correlation with the Laramie flora of the so-called Miocene of Mackenzie river, Alaska, Greenland and Spitzbergen, and believes that they should be regarded as not newer than Eocene.

The greater part of the paper is occupied with the description of the fossil plants of the formation, including those collected in the Eastern area by Dr. Selwyn and Dr. G. M. Dawson, and those obtained from the Western area by the latter, Mr. Weston, Mr. Tyrrell and the author. These include a large number of exogenous trees, all belonging to modern genera, as Platanus, Corylus, Populus, Salix, Viburnum, Carya, Juglans, etc. There are also some curious plants allied to the modern trapa or water chestnut and coniferous trees of the genera Taxodium, Sequoia and Salisburia, as well as some ferns and equisetaceous plants of much interest, more especially in reference to their geological and geographical distribution.

Notes on the Variation of certain Tertiary Fossils in overlying Beds.—In the Southwestern Old-tertiary there are some high vertical exposures, which show different fossiliferous beds vertically above each other. One of them is the profile near Vicksburg, described in the *Amer. Journ. of Science*, xxx, 1885, p. 71. The "Higher Vicksburgian," consisting mainly of reddish sands, contains those fossils usually known as Vicksburgian fossils; the bed, "Lower Vicksburgian," a dark grayish marl, contains a very similar but not entirely identical and less numerous fauna; both are separated by about thirty feet of limestone. Some of the lower species are not known from the higher bed, which, however, is at least partly owing to different methods of collecting in both beds. The main number of species of the lower bed occurs also in the higher one. In most of them, for instance, *Buccinum mississippiense* Conr., *Sigaretus mississippiensis* Conr., *Pleurotoma congesta* Conr., *Murex mississippiensis* Conr., *Terebra divisura* Conr., *Trochita trochiformis* Lea, *Turritella cœlatura* Conr., I cannot detect differences between the forms in the higher and lower bed; but in two cases at least there occur differences; *Cytherea sobrina* Conr. from the lower bed is in general longer than from the higher bed. Ten specimens of the higher bed, taken without special selection, showed, if the height is put as 1.00, a length varying from 1.19 to 1.29, with an average length of 1.23. Ten specimens of the lower bed, also taken without special selection, had a length varying from 1.24 to 1.33, with an average of 1.30. More striking is the relation of the two forms of *Ficus mississippiensis* Conr., which species in the lower bed is quite common. In the form of the higher bed the revolving lines are more developed. On the end volutions of the same age and size in both varieties, the higher variety shows one more system of revolving lines. This difference between the two varieties is not very striking, but is large and constant enough to distinguish the forms of the two beds without reference to the lithological contents of the shells. The following diagram represents the plan of the origin of the revolving lines as they can be traced along the volutions of each form:



I, lines of the form of the "Lower Vicksburgian;" II, lines of the form of the "Higher Vicksburgian."

The conclusion to be made is that the two species changed somewhat during the time which is represented by the bed of limestone.

By the Geological Survey of Alabama there has been made out, by a series of profiles, that certain fossiliferous Tertiary beds are successional in age, for instance, that the Woods Bluff beds are older than that of Hatchitigbee bluff, this again is older than the Lisbon strata, which finally are overlaid by the Claibornian. In these consecutive beds we frequently find the same species, sometimes without apparent change, sometimes represented by slight variations and in some cases by strongly modified variations. This material from Alabama, which I refer to, is in the collection of Mr. T. H. Aldrich.—*Otto Meyer.*

GEOLOGICAL NEWS.—*General.*—Capt. Dutton, in his memoir upon the volcanoes of the Pacific islands, examines and rejects the following four theories of the origin of volcanic action: (1) Access of water; (2) penetration of oxygen; (3) mechanical crushing through the horizontal pressure due to the cooling of the interior; (4) local development of heat from unknown causes. Elevatory movements are by him referred to expansion or to an increase of matter, and the former hypothesis is accepted as agreeing best with observed facts.——Among the samples of rocks collected during the soundings of the *Talisman*, mostly from depths of 4000 to 5000 meters, the older metamorphic rocks are more generally represented than the eruptive series. There were seventy-three specimens of limestones, sixteen of arkoses and nineteen of sandstones, the latter sometimes rich in remains of biotite and muscovite.——From the collections of Lieut. Giraud it appears that the region of Lakes Tanganyika and Nyassa is principally composed of primitive rocks. Schistose rocks, containing remains of Lepidosteus, were collected at Yendivé, south of Tanganyika, and at Mpasa, north-west of Nyassa. These are referred by Reymond to the Upper Cretaceous or Lower Tertiary age.

Palæozoic.—The occurrence of glacial conditions in the Palæozoic era was maintained by Dr. W. T. Blanford in a recent communication to the London Geological Society. The action of ice was evident in the Karoo formation of South Africa, the Gondwana system of India, and the coal measures and associated beds of Eastern Australia. Mr. R. Oldham, the Rev. W. B. Clarke and others had clearly showed that in Australia beds, containing Glossopteris, Phyllotheca and Nœggerathiopsis were intercalated among marine beds and Carboniferous fossils. Abundance of smooth and striated boulders had been found by Mr. Oldham in the marine Carboniferous beds north of Newcastle, N. S. W. Other boulder beds existed in the Talchir beds of India, and also near Herat in beds also containing Talchir fossils. Dr. Blanford considered it probable that these boulder-beds marked approximately the same glacial period, which probably occurred towards the close of the Palæozoic, and resulted in the extinction of many of its peculiar forms. The peculiar flora of the Newcastle beds and of the Indian Damudas proved the existence of botanical provinces in past ages.

Tertiary.—M. Cotteau has submitted to the Paris Acad. of Sciences a description of the Eocene species of the echinid genera Sarcella, Gualtieria, Echinocardium, Leiopneustes and Brissospatangus. *Sarcella sulcata*, peculiar to the Upper Eocene beds of Biarritz, is remarkable for its large and strongly strobiculated tubercles, the arrangement of its internal fasciole and the peculiar structure of its ambulacral areas; *Leiopneustes antiquus* has no fascioles; and *Brissospatangus canmonti* may be known by its very excentric anteriorly placed ambulacral summit and its short, transverse and widely separated anterior paired ambulacra, situated in a depression. The Brissidæ appear in the Cretaceous, reach their maximum in the Tertiary and still persist in most seas.——The Cretaceo-Eocene limestones of the Jaulan and Hauran regions, described by Mr. G. Schumacher, seem to have been deposited, upraised and largely denuded, before the volcanic lavas of the district were forced out. As this movement and denudation took place in the Miocene epoch, the volcanic eruptions may be referred in the main to the succeeding Pliocene.——The so-called delta of the Orinoco, according to A. Ernst (*Nature*, Feb., 4th), has not been formed by the river. At the end of the Tertiary period a sudden subsidence formed the Golfo Triste, the Gulf of Cariaco and many of the lagoons in the provinces of Cumaná and Maturin. The southern branch is the old river channel, but when the land on the left bank sank gradually towards the north, part of the waters, following the new slope of this northern plane, cut into it the various channels with their connecting branches which, after a slow and tortuous course, empty into the sea between the old mouth of the river and the southern entrance of the Golfo Triste. At the time of this movement extensive tracts of land to the north of the mountains which run through the whole length of the peninsulas of Araya and Paria were also submerged and thus the Sea of Carupano was formed. Previous to this the South American mainland (as shown by Mr. Bland in his investigation of the West Indian shell fauna) extended to Grenada, Tobago and Trinidad. Tobago is still within the 100 fathom line. It is evident that an immense quantity of organic matter must have been buried with the sunken land to form the source of the bitumen and other carbo-hydrates of the vicinity.

MINERALOGY AND PETROGRAPHY.[1]

PETROGRAPHICAL NEWS.—Renard, in the course of his work on the rocks collected by the *Challenger* in 1874, has found some interesting material among the specimens collected from the volcanic islands in the Polynesian group. Most of the larger islands he thinks will be found to consist of crystalline schists, which the ancient and younger lavas have in turn overflowed and concealed. As evidence of the fact that some of the rocks found in these islands are of pre-Tertiary age, Renard describes[2] two slides from Cebu, one of the Phillippine group. One of these consists of porphyritic crystals of olivine, Baveno twins of Bytownite or labradorite and broken crystals of augite in a microcrystalline ground-mass of plagioclase, augite and viridite, possessing a well-marked flow structure. As all the constituents are much altered, with the production of considerable epidote, the author supposes this rock to be an olivine diabase or a melaphyre. Under the influence of the gaseous emanations from fumaroles the plagioclase is changed into a mixture of albite, saussurite and epidote, the bisilicates into chlorite and pyrite. Gypsum associated with pyrite is a frequent result of the action of sulphuric acid vapors on both older and young lavas. On the Island Malanipa serpentine occurs. This is cut in all directions by veins of chalcedony, and is obviously the result of the decomposition of peridotite. Quite a number of slides of specimens gathered from the Moluccas,[3] Banda[4] and the Fiji[5] islands were examined. They prove that the predominating rock on all these islands is augite andesite. On the Island Ternate,[3] which consists almost entirely of a single volcanic peak, in addition to the andesite there occurs basalt. The former rock is composed of a glassy base with numerous devitrificative products and porphyritic crystals of zonal labradorite, twinned, pleochroic augite with an extinction of from 44°–50°, and magnetite. In the augite the pleochroism is $\underset{\text{reddish-yellow}}{a + b} > \underset{\text{greenish}}{c}$. By the action of the volcanic gases the basalt is almost completely changed into a quartziferous aggregate in which are occasional grains of augite and plagioclase, and very rarely the remains of olivine. In an altered rock from Banda[4] the plagioclase crystals are filled with cracks and fissures, into which a colorless isotropic substance has penetrated, in many instances replacing entirely the feldspar. A chemical analysis of the fresh unaltered andesite from this island shows it to contain from fifty-six to fifty-nine per cent of silica, while the altered variety contains as high as ninety per cent.

[1] Edited by W. S. BAYLEY, Johns Hopkins University, Baltimore, Md.

[2] Bulletin de l'Acad. Roy. de Belgique, III, 2, p. 95.

[3] Ib., III, 2, p. 105.

[4] Ib., III, 2, p. 112.

[5] Ib., III, 2, p. 156.

Opal replaces the original constituents of the rock, first replacing the feldspar, then the augite and finally the glass base. Occasionally this silica takes the form of tridymite. Near the port of Kantavu, on one of the Fiji[1] islands, quite a number of hornblende andesites were found. In a yellowish glassy base, containing numerous microlites of feldspar, augite and grains of magnetite, large porphyritic crystals of labradorite, hornblende and biotite occur. The hornblende often possesses the two pinacoids well developed. In some cases this mineral is surrounded by a rim of small, colorless or very light-green augite crystals, arranged with their long axis parallel to the long axis of the hornblende. In other cases the hornblende passes over into a perfect pseudomorph of brown biotite, which can be distinguished from the original biotite by the fact that the hexagonal sections of the secondary mineral are composed of tiny fibers lying parallel to one of the pinacoids of the hornblende from which it was derived, while those of the original biotite appear homogeneous.—— Fouqué reports[2] that the rock of Gamboa, on the line of the Panama canal, is an augitic labradorite containing hornblende. The porphyritic crystals of labradorite, augite and magnetite occur in a microlitic base, which has been transformed in greater part into chlorite.——The rocks collected during the cruise of the *Talisman*, in 1883, have been given to Michel Lévy for examination. Two hundred and fifty slides of specimens collected between the depths of 4000–5000 meters have been examined. By far the largest number of these are of rocks of the "old metamorphic series." ——The igneous rocks of the ridge known as Stanner rock, near old Radnor, Shropshire, England, are stated by Cole[3] to consist of an acid series intrusive in a more basic series. The most highly crystalline member of the former is a "pale pink-grey pegmatite," passing through a well-defined graphic granite into a micropegmatite form. The less crystalline members of the acid series are felsites with well-developed spherulitic structure. Corroded quartzes, surrounded by the the "quartz globulaire" of Fouqué and Lévy, were observed in most of these felsites. The more basic series is composed of diabases, diorites and rocks intermediate between these, with a few in which the author thinks he has found evidence of previously existing olivine.——Chrustschoff has just published[4] an interesting article on "pyrogeous quartz and tridymite." Inclusions of granite and quartz in the basalt of Striegan were partially dissolved, and around them a secondary crystallization of quartz took place. These new crystals are frequently bounded

[1] Bulletin de l'Acad. Roy. de Belgique, III, 2, p. 156.

[2] Comptes Rendus, CII, No. 14, p. 793.

[3] Geological Magazine, May, 1886, p. 219.

[4] Mineralogische und Petrographische Mittheilungen, VII, p. 295.

by crystal planes. They enclose glass areas which are derived from original inclusions, and contain also fluid inclusions with movable bubbles. Tridymite is much more rare under these conditions than quartz. It is usually found lining cavities around the periphery of glass particles or veins, and is generally free from inclusions. The granitic feldspar is likewise in many cases surrounded by a rim of "neogenous" feldspar, which frequently builds around the original irregular fragment a completely developed crystal. The newly-formed feldspar is much less opaque than that from which it was derived, and contains fewer inclusions. Among those that occur are little fluid cavities containing movable bubbles. A most instructive portion of the paper is that which treats of the experiments which were undertaken by the author to explain the origin of the secondary fluid inclusions, and to find the conditions under which the silica separated out in crystal form.——Pöhlman[1] has recently described biotite-gneiss, quartzite, olivine-kersantite and nepheline-basalt from the northern part of Paraguay. The olivine-kersantite contains, in a dark gray ground-mass, large crystals of biotite (meroxan), perfectly fresh augite and flesh-colored pseudomorphs of olivine. These pseudomorphs consist of serpentine, very pleochroic bunches of a micaceous mineral, carbonates and iron oxides.——According to Carl Ochsenius,[2] the blue color of much of the Strassfurt salt is not due to sulphur, but is merely an optical effect.

Mineralogical News.—Emmonsite, a new mineral from near Tombstone, Arizona, has been described by W. F. Hillebrand.[3] It is of a yellowish-green color, translucent, and occurs in crystalline scales and patches in a brownish gangue composed of lead carbonate, quartz and a brown substance containing iron, tellurium and water. The mineral is probably monoclinic, with a good cleavage parallel to the clino-pinacoid. Cleavage pieces show two other directions of imperfect cleavage nearly at right angles to each other. Against one of these the extinction is 8°–12°. Pleochroism very slight. Specific gravity about 5. After allowing for impurities the mean of four analyses was as follows:

Te	Se	Fe	H_2O
58.75	0.53	14.29	above 3.28

It is most probably a hydrated ferric telluride.——Twins of cinnabar[4] have been found in the recently discovered ore deposits in the neighborhood of Bachmut, Ekaternioslaw, South Russia. The crystals are inter-penetration twins with the base the twinning plane and the twinning axis the vertical axis. The planes

[1] Neues Jahrbuch für Min., etc., 1886, I, p. 244.

[2] Ib., p. 177.

[3] Proceedings Colorado Scientific Society, Vol. II, Pt. I, 1885, p. I.

[4] Ischermak. Miner. u. Petrogr. Mitth., VII, p. 361.

on each crystal are R, 2R, and the trapezohedron $\frac{2P\frac{4}{3}}{4}$. When the tetartohedral plane is on the right edge of an upper rhombohedral face the crystal is dextro-rotatory.——The jeffersonite of Franklin, N. J., has been investigated crystallographically and chemically by Kloos, of Stuttgart.[1] In the prismatic zone only $\infty P \grave{\infty}$ and ∞P were found. The crystals were terminated by oP, $\pm P$, $2P\grave{\infty}$ and $3P\grave{3}$. The pleochroism is strong $\mathfrak{a}$ = honey-yellow, $\mathfrak{b}$ = yellow-green, $\mathfrak{c}$ = blue-green. Absorption $\mathfrak{c} > \mathfrak{a}$. Sections parallel to the clino-pinacoid gave an extinction of 17° 15′ against the vertical axis. Specific gravity 3.352. A chemical analysis yielded:

SiO_2	TiO_2	Al_2O_3	Cr_2O_3	Fe_2O_3	FeO	MnO	ZnO
39.59	1.76	11.20	0.13	5.97	11.31	3.07	0.53

MgO	CaO	Na_2O	K_2O	H_2O	total
8.42	12.85	3.31	1.95	1.02	101.11

In the light of this result the author does not feel justified in assigning to this mineral any definite constitution. The small amount of MnO would seem to indicate that the mineral under investigation is not a true jeffersonite.——Brauns[2] has discovered a new plane $\frac{17}{16}P\bar{\infty}$ in manganite from near Oberstein a. d. Nahe. ——In the clefts of a piece of soapstone from Göpfersgrün, near Wunsiedel, Sandberger[3] has found uranite and torbernite in little quadratic tables. Pseudomorphs of arsenio-siderite after siderite from Bulach in Würtemberg and greenockite from the clefts of zincblende from Brilon, Westphalia, and Neu-Sinka, in Siebenbürgen, were also found and examined by the same investigator.

BOTANY.[4]

FIGURES OF SOME AMERICAN CONIFERS.—Dr. M. T. Masters read a paper entitled "Contributions to the history of certain species of Conifers" before the Linnean Society, in January of the present year, in which some American species are critically discussed. They are as follows, viz:

Abies amabilis Forbes. This is accompanied with a nearly full-sized figure of the cone, a photo-engraving of a sterile branch, with half a dozen enlarged figures of leaves, leaf-sections, bracts, scales and seeds.

Abies grandis Lindley. A large double plate showing five cones, with figures showing details of leaf and cone structure, illustrate this species. The variety *lowiana* (= *Picea lowiana* Gordon, *Picea parsonsiana* Barron, *Abies lowiana* McNab) is described and figured. A second variety, *pallida*, is doubtfully separated. Its leaves are "of unequal length, flat, and pale in color."

Abies concolor Lindley. Figures of the cone, foliage, leaf-structure, bracts and scales illustrate this species.

Abies subalpina Engelm. Full illustrations accompany the description of this species.

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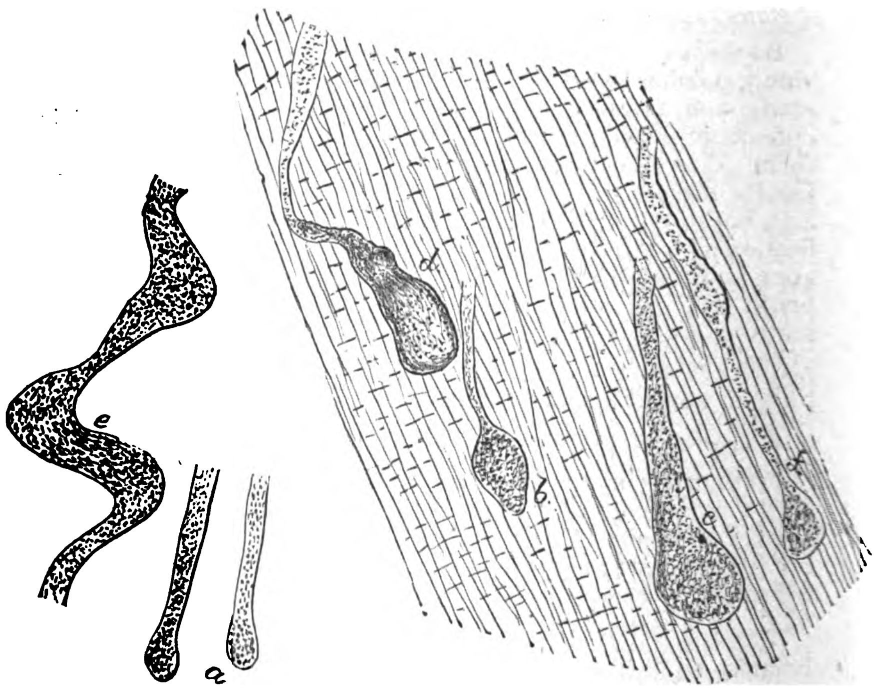
[1] Neues Jahrb. für Min., etc., 1886, I, p. 211.
[2] Ib., p. 252.
[3] Ib., p. 250.
[4] Edited by Professor CHARLES E. BESSEY, Lincoln, Nebraska.

Abies nobilis Lindley. The typical form of this species is illustrated by a large double plate showing the foliage and cone, with details of the latter. The variety *glauca* occurs in cultivation. The variety *magnifica* (= *Abies magnifica* Murray) is illustrated by a large double plate showing cones and foliage. Details of the leaf and cones are given in wood-cuts.

STRANGE POLLEN-TUBES OF LOBELIA.—The pollen-tube as figured in the text-books and elsewhere is of nearly uniform diameter throughout its whole length. The lower portion, or that farthest from the grain (or spore) is usually shown with its contents denser than elsewhere. In the style of the *Lobelia syphilitica* I find that the ordinary form of the end of the pollen-tube is as shown at *a*. Occasionally the enlargement at the tip takes the form of nearly a perfect sphere. A spade-like form met with is



shown at *b*. At *c* is shown a pollen-tube tip that is quite exceptional. The end through the thickest part is fully four times the ordinary diameter of the tube. A still more irregular tip is shown at *d*. The tube is much swollen at the extremity, while back from the end are two contractions, after which the tube is attenuated for a distance upward and again assumes its normal size. These changes in size do not all take place in the same plane. The tube twists in various directions in the substance of the style. The extent to which this variation from a direct course may proceed is seen at *e*, which shows a portion of a pollen-tube probably only a short distance behind the tip. The end in this case was not found. The twisting increases the chances of a single tube not holding together when subjected to the razor or needles of the investigator.

All of the parts of the illustration were drawn with a camera lucida—a Grunow, which thus far has proved itself among the best. The tubes *b c d* and *f* hold the same positions to each other as they did in the conductive tissue of the style. This was an unusually rich spot in odd forms. The conductive tissue seemed loose, and there was no apparent cause for any change of direction or the formation of enlarged end. No nucleus was observed in any of the tuber-like tips. I hope to cultivate the pollen free from any tissue and observe the results.—*B. D. Halsted, Botanical Lab. Agricul. Coll., Ames, Iowa.*

Books on Fungi.—The American student of fungi is often sorely puzzled for want of a systematic manual to aid him in his study and classification of the multitude of species which he collects or *might collect* if he could hope to do anything with them. The book which has been of most service is probably Cook's Hand-book of British Fungi, published about fifteen years ago, but its descriptions are so imperfect and the system of classification so antiquated that from the first it has been an exasperating book to use or to put into the hands of students. Of American books there are none. We have some local lists and a good many scattered papers. Dr. Farlow has given us excellent monographs of several genera. Mr. Peck has likewise published many descriptions and a number of monographs. Mr. Morgan has helped us by giving us his Mycologic Flora of the Miami valley, Ohio. Ellis and Everhart have published monographs of a number of genera. By securing complete sets of *Grevillea*, the *Torrey Bulletin*, *Botanical Gazette*, *Journal of Mycology*, American Naturalist and the proceedings of several scientific societies, and in addition the reports and bulletins issued by various States and colleges, one can do something, but how many, aside from the specialists, can afford to supply themselves with all these?

Two books now publishing will do much to help the ordinary botanist and botanical student. Several years ago Dr. George Winter began the publication of a new edition of the volume "Die Pilze" (fungi) of Rabenhorst's Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz. The first book of this work was completed in 1884. It includes the Schizomycetes, Saccharomycetes and Basidiomycetes. This latter class, in accordance with Winter's views, is made to include the Entomophthoreæ, Ustilagineæ and Uredineæ, in addition to the Tremellineæ, Hymenomycetes and Gasteromycetes. The second book has progressed as far as p. 592, and is thus far devoted to the Ascomycetes. From present indications this book at least will be required for the Ascomycetes, and a third book will be necessary for the three remaining classes, viz., Myxomycetes, Zygomycetes and Oömycetes. The great value of this work lies in the fact that the descriptions are very full, and include accurate measurements.

In the year 1882 P. A. Saccardo began the publication in Padua, Italy, of what is destined to be one of the great books of the century, the Sylloge Fungorum, designed to contain all the known fungi of the world. The first and second volumes are devoted to the Pyrenomycetes, of which great group about 6000 species are described. The third volume, devoted to the Sphæropsideæ and Melanconieæ, appeared in 1884. It contains descriptions of over 4000 species. Volume IV appeared in April of the present year. It is devoted to the Hyphomycetes, and describes over 3500 species.

The descriptions in Winter's work are in German, those in Saccardo's Sylloge, in Latin. Both are full, although the treatment is much more satisfactory in the former. Saccardo merely compiles, and thus often admits the same plant under more than one name, while Winter is exceedingly critical. The latter is therefore the better guide, while the former, by his liberality in admitting so many descriptions, makes these available for the critical study of students everywhere.—*Charles E. Bessey.*

A Pocket Manual of Botany.—It would puzzle any one to make out just what the publishers of the ordinary botanical manuals had in mind when they decided upon their type, paper and binding. A manual ought to be a field book. It should be portable, with a size and weight allowing it to be carried as the companion of the collector wherever he goes. Every beginner in systematic botany ought to carry his manual with him, but it is too much to ask him to carry a two-pound book in addition to his other burdens, especially when the book is too big to go into any of his pockets. Nearly five years ago the writer brought this matter to the attention of publishers (Am. Nat., Vol. xv, p. 896) and some favorable correspondence resulted from it. But we still have the old-fashioned coarse print, thick paper, broad margined, clumsily bound manuals for use in the schools and colleges.

In the "Tourists' edition"[1] of Coulter's Botany we have the nearest American approach to the style of book with which collectors and students should be supplied. By the use of thin paper the thickness of the book is reduced to considerably less than an inch which, with the flexible leather binding, makes a book which can be carried much more comfortably than could the ordinary edition. Had the binder been instructed to trim the pages so as to leave a much narrower margin all around, the book would have been much improved. In order to test the

[1] Coulter's Manual of Rocky Mountain Botany. Tourists' edition. Ivison, Blakeman, Taylor & Co., New York and Chicago, 1885.

matter the writer took his copy to a binder and had the margins cut down, resulting in what is probably the handiest botanical manual in the country. This improved copy is now exactly seven and three-eighths inches long and four and seven-eighths wide, and weighs but thirteen ounces. It slips into an ordinary pocket with the greatest ease, and can be carried by the collector wherever he goes.

Now it must be remembered that this reduced copy of the "Tourists' edition" is printed from the identical plates used for the large book, and that apparently no attempt was made by the printer to reduce the size of page by printing closer to the *inner margin*, where at least a quarter of an inch might easily have been saved. It is probable that with considerable care the width of the book might be reduced to four and a half inches.

Until we can have something better let us have thin-paper editions of Gray's, Coulter's and Chapman's manuals, printed and bound with narrow margins *all around*, and with flexible covers which project but little if at all beyond the pages. Then let our publishers seriously consider the problem of giving us all this at a moderate cost.

When new editions of these manuals are made, the publishers can save much space by the use of thinner leads, so as to crowd the matter closer upon the pages. In this way not far from seventy-five pages might be saved, while by the use of smaller type here and there the saving might be easily carried to a hundred pages. A little book of 392 pages—the Tourists' Guide to the Flora of the Alps—lately issued by an English firm, might well be taken as a model. Of it a recent reviewer says: "Printed in clear type on thin paper, and bound in red leather in pocket-book form, it weighs less than five ounces, and is thus really suited for the pocket." And yet this book is sold for five shillings, that is, for about two-fifths what is charged for Coulter's "Tourist!"—*Charles E. Bessey.*

A CHEAP HAND-BOOK OF MOSSES.—One of the neatest little botanical books which has appeared for many a day is the Handbook of Mosses, by J. E. Bagnall, and published by the well-known London firm of Swan Sonnenschein & Co. It is a thin duodecimo book of about one hundred pages, contains thirty-nine illustrations, is bound in cloth with tastefully ornamented cover, and sells for one English shilling.

The chapters treat of the following topics, viz: Appliances and material required for the study; development; moss habitats; classification; geographical distribution; cultivation; uses; preparing specimens for the cabinet and herbarium. The chapter on classification treats the subject in a general way only, giving no more than the characters of the tribes.

We wish it were possible for American publishers to put a book of the quality, size and price of this one upon the market.

Botanical News. — Professor Seymour's lecture before the Minnesota Horticultural Society, in January last, is a model of what such a lecture should be. It deals plainly with a few common but imperfectly understood fungi of the fruit-garden, viz., the rusts of the raspberry and blackberry (*Cæoma nitens* and *Phragmidium rubi-idæi*); the "double blossom" of the blackberry (*Fusisporium rubi*); the raspberry "cane rust" (probably *Sphaceloma ampelinum*); and the currant disease (*Septoria ribis*). The lecture, now published in pamphlet form, closes with a few well-chosen remarks about the investigation of the parasitic fungi.——Professor Tracy has just published in the eighteenth annual report of the State Board of Agriculture a catalogue of the flora of Missouri. It includes phanerogams and pteridophytes only, and yet there are enumerated 1749 species. A study of the list shows the State to contain four well-defined botanical regions: (1) The Mississippi and Missouri *river-bottoms*; (2) the *swamp region* of the south-east; (3) the *Ozark region*, south of the Missouri river; (4) the *prairie region* of the northern and western portions of the State.——The Botanical Club of the American Association for the Advancement of Science will hold meetings in August at Buffalo, and will meet with a warm reception from the botanists and citizens of Buffalo. Although the arrangements are not yet completed, it can quite confidently be announced that the club will be tendered a half-day excursion to some one of the several interesting collecting grounds of that vicinity. The long excursion on Saturday will also be arranged to enable the botanists to have a portion of the time for collecting. The localities near the city which have been described by Mr. Day in his catalogue of Buffalo plants will prove as interesting to visiting botanists as those of any city yet visited by the club. There will also be tendered to the club, without doubt, an evening reception. There will be no lack of opportunities for becoming acquainted with one another. The first meeting of the club will be held in the room assigned to biology on Thursday morning at 9 o'clock, which is the second day of the association. Subsequent meetings will be announced on the daily programme of the association. It is hoped that the botanists will be out in still larger numbers this year than they were last, or the year before. Let every teacher of botany arrange now to be present at the meetings. The secretary of the club is J. C. Arthur, of Geneva, N. Y.

ENTOMOLOGY.

Description of the Form of the Female in a Lampyrid (Zarhipis riversi Horn.)—

♀. Apterous, vermiform, segmented, retractile, phosphorescent. Number of joints, exclusive of the head, twelve. Legs six, two on each of the three anterior segments, or on those portions underneath representing the pro, meso and meta-sternum. Length, when extended in walking, two and a quarter inches; and the width across the widest part five-sixteenths of an inch.

Head corneous, shining black and not well defined and when at rest hidden beneath the anterior segment. The prominent character of the head consists of a pair of curved hook-like mandibles like those of the male. Antennæ short, straight, four-jointed; the apical joint bristle-like and growing out from the side of the end of the previous joint, which is the largest and tubular in form.

Maxillary palpi five-jointed, four being nearly equal and bead-like.

Labial palpi appear two-jointed. The antennæ and palpi being short, stand stiffly out from their base.

Dorsal surface consists of twelve thin corneous plates, the three anterior being narrowed in front and all having an impressed line through the center. The plates are shining, blackish brown, margined transversely with transparent olive green, and upon the longitudinal margins with opaque pale yellow interspersed with olive, which colors intermixed obtain upon the sides and the underparts generally.

Spiracles upon the sides of the fourth to the eleventh segments, inclusive, and just below the spiracles on the same segments is a double fold forming a double lateral ridge. The other segments bear but a single fold and no spiracles.

The thoracic region bearing the legs exhibits indistinct sutures and folds presenting but a faint resemblance to analogous parts in other Coleoptera.

The legs are of the type seen in the female in some Lampyridæ and are four-jointed with a short obtuse tarsal claw. The legs in the larval stage of this insect differ from those in the adult by being flattened on the under side into a ridge which is strongly setose, and the claws of all the legs are twice as long, more curved, finer and more sharply pointed than in the fully grown insect.

In Bull. Cal. Acad. Sci., II, 5, p. 71, April, 1886, are to be found some references made by me to a large luminous larva of some coleopteron, and I also gave an account of its habits. This luminous larva, then alluded to, is an earlier stage of the insect I have described above.

The larva fed all winter, and in March sloughed its skin and remained motionless, coiled in a cell of earth for three weeks, and kept a uniform pale-cream color without luminosity, but gradually the center of the dorsal plates became darker, and in the ratio of coloring so was the reappearance of phosphorescent light; when fully restored in strength it became very active and strongly luminous, but it did not eat. In about a week it disappeared beneath the earth, and remained out of sight for nearly a month, and thinking it had changed into the pupa state I disturbed it, and found no change to have taken place. I returned it to the jar, placing the coiled insect upon the top of the earth, where it lay motionless for two days. On the morning of the third day I found it had sloughed another skin, but this time a very thin covering of uniform pale brown, and the insect itself had disappeared into the earth. This last dormant stage must represent its pupa state. I unearthed it again and found it very soon afterwards to assume great activity and bright luminosity, but it would take none of the usual food. Thinking a fresh supply of earth to be beneficial, I removed the jar into the garden and emptied the earth by the stump of a tree, and while in this act several specimens of Zarhipis pitched upon the discarded earth, and one specimen dropped swiftly upon the until then supposed larva, throwing the female into violent movements by the suddenness of the attack. The male soon attempted copulation. The act, if it really took place, is not one of adhesion like that in the Telephoridæ. The method was alike in a number of examples, the attraction of the female was perfect, and through it I captured eleven males.

The light occurs most intense on the cross margins of the dorsal plates, but the luminosity is also strong on all the margins as well as along the lateral edges. Sometimes the insect appears checkered by being banded with phosphorescence.

The eleven males attracted were not all of the form known as *Z. riversi* Horn; some represent the *Z. piciventris* Lec. These facts will cause some revision of the genus.

The foregoing statements can hardly be considered as a perfect history of this peculiar insect, because there are many points not yet worked out.

Why the larva should be luminous, and yet have nothing to attract, and why the adult ♀ should be luminous, while the ♂ is not nocturnal, but roams in the sunlight, are still unanswered questions. The habit of the male is to appear on the wing, in temperate heat, from 9 A. M. to 4 P. M., but during the hottest weather it does not appear until the sun is declining.

Then what are the differences in the larval form of the sexes, or, are there any larval differences of the sexes? The answer to these queries will come after observation; but the answer to the one concerning the luminous characteristics of the larva and adult form may perhaps give way to theory and it may be suggested that the luminous quality is inherited, and though without use to this species having a diurnal habit, yet it may be a derived character that only comes into use when the habit is nocturnal. But it must be considered that the plumose antennæ of the male would indicate that it seeks its mate by scent.—*J. J. Rivers, Univ. of Cal., Berkeley, Cal.*

History of the Buffalo Gnat.—The report of the U. S. entomologist for 1884 contained an article on the subject of the Southern buffalo gnat (Simulium sp. or spp.) which discussed the great damage done to stock each year along the Lower Mississippi and the habits of the allied species in this country and in Europe. At that time the particular species concerned had not been determined nor had the larvæ and pupæ been found. The habits of the insect in its earlier stages were surmised to be similar to those of allied species, but as the species that had been studied, breed, as a rule, in streams that are clear, rapid and rocky, it was a question how the insects bred in such great quantities in the low alluvial Mississippi country. Considering the great damage done by these gnats it was also a question of considerable importance, as its solution might afford a means of checking the increase of the pest. The present spring Dr. Riley has therefore, with the aid of two of his assistants, Mr. F. M. Webster and Mr. Otto Lugger, endeavored to clear up the mystery surrounding this pest, and has already succeeded. Mr. Lugger, whose post has been at Memphis, Tenn., has found the larvæ and pupæ of one species of Simulium, and Mr. Webster, at Vicksburg, has found the earlier stages of another, somewhat larger species. The habits of both species are similar, and both have been found to breed in the more swiftly-running portions of the smaller creeks and bayous which are permanent and do not dry up in midsummer. They are found attached to the masses of drift-wood and leaves which form at points and which, by impeding the streams below, form a more rapid current at the surface. The larvæ and pupæ have been absolutely connected with their respective adults, and a careful study of the general character of the breeding places already indicates that the increase of the pests of late years is indirectly due to the crevasses in the levees, and that we have here another strong argument for the preservation and care of these last.

LARVAL FORM OF POLYDESMUS CANADENSIS.—While at Enterprise, Fla., I found, April 8th, under a palmetto log a *Polydesmus canadensis* with its body encircling a mass of white, oval eggs, each about half a millimeter in length and with a thin chorion. They were enclosed in a slight nidus. Placing the eggs and the myriopod, with damp sand and mold, in a close tin box, and bringing them home, I found the young had hatched about the 9th of May. The larva, soon after hatching, is short and thick, the body composed of eight segments and ornamented with scattered, large, somewhat club-shaped spines. The antennæ are four-jointed. There were only three pairs of legs, and they were appended to the first, third and fourth segments respectively, there being none on the second segment behind the head. Length of the animal 1.2^{mm}.

The larva is essentially similar to that of the European *Polydesmus complanatus*, figured by Metschnikoff (*Zeits. wissen. Zool.*, XXIV, pl. XXVI, fig. 7), but apparently has one more segment.—*A. S. Packard.*

OCCURRENCE OF EARLY STAGES OF BLEPHAROCERA.—I send you by express a small package containing specimens of larval forms that I collected last summer at Gilboa, Schoharie county, N. Y. They were all found in the same situation, viz., on the rocks in a water-fall, at the place where the water ran most swiftly, generally on the edge of the rocks. The larvæ of the black fly were so numerous that the edges of rock were black with them. The mode of attachment to the rocks is by a chitinous ring, armed with longitudinal rows of hooks. The tubercle on the prothorax is also provided with a similar disk. These disks served as organs of locomotion as well as of attachment. Just above the disk, at the posterior extremity of the body, on the dorsal surface, there is an opening through which, in many specimens, a tufted organ appears, which I do not remember to have seen in other larvæ.

The intestine in the specimens is solidly packed with the remains of diatoms.

Of the other specimens I send, the one marked No. 3 seems to be the pupal form of No. 2. They were constantly associated, and I saw no other forms near them except the black-fly larvæ. The mode of attachment to the rocks is the same in both, by sucking disks. In No. 3 the disks were on the extremities of the abdominal segments, three on each side. In most cases in removing the specimens from the rock the disks were separated, but there is one specimen I send in which they are still in situ, and are very distinct, and I think they are shown in some of the others.

The protuberances on the dorsal surface of the head of No. 3 I supposed to be breathing organs, as they are composed of lamellæ which the animal had the power to open and close. There were numerous empty cases on the rocks, but they seemed to be only the abdominal disk-bearing segments, the upper or anterior portion being carried away by the rapid flow of water as soon as the animal deserted it.—*Fanny R. Hitchcock.*

[The insects have been identified for us by Dr. C. V. Riley.—*Eds.*]

Entomological Notes.—The Ceylon entomologists propose to systematically observe the singular migrations of butterflies in that island. Volunteers are to watch for the migration and send a post-card bulletin to the editor of the records, noticing data, direction of flight, of wind, the weather and the species.——Professor C. H. Fernald's "Sphinges of New England" gives descriptions of the moths and larvæ, the number of species being forty-two. It will prove to be a very convenient manual of our hawk-moths.——Dr. Uhler's Check-list of the Hemiptera Heterocera, published by the Brooklyn Entomological Society, is a timely publication. It is synonymical, and also gives the geographical distribution of the species. Having been compiled under difficulties it is not to be wondered at that a few species, even some of Dr. Uhler's, have been omitted. The number of described species is 1448.——Mr. W. H. Ashmead has published the seventh of his studies on the North American Chalcididæ. ——From Professor F. M. Webster we have received an essay on horticultural entomology, read before the Indiana Horticultural Society.——At the January 10th meeting of the London Zoölogical Society, Mr. H. J. Elwes read a paper on the butterflies of the genus Parnassius, with special relation to the development, functions and structure of the chitinous pouch found in the females. He had recognized twenty-three species.——Before the French Academy, J. Gazagnaire read a paper on the seat of the organ of taste in Coleoptera.

ZOOLOGY.

PHYSIOLOGICAL SELECTION.—At a recent meeting of the Linnean Society, Mr. G. J. Romanes read a paper "On physiological selection: an additional suggestion on the origin of species." The author contended that the theory of natural selection has been misnamed a theory of the origin of species. It is, in truth, a theory of the origin of adaptive structures, and, if unassisted by any other principle, could not effect the evolution of species. The only other principle that could here assist natural selection would be one that might mitigate the swamping effects of intercrossing. This may be done by geographical barriers shutting off a portion of a species from the rest, and allowing that portion to develop an independent course of varietal history without intercrossing with the parent form. It may also be done by portions of species migrating, changing habital stations, &c. But it may also be done by what the author calls physiological selection, or in virtue of a variation taking place in the reproductive system in the direction of sterility (whether absolute or partial) with the parent form, without impairment of fertility within the varietal form. For instance, the season of flowering or of pairing may be either advanced or retarded in a portion of a species, when all the individuals in that portion (or new variety) would be absolutely sterile towards the rest of the species, while completely fertile among themselves. They would thus start on an independent course of variated history.—*English Mechanic.*

MECHANICS OF SOARING.—Professor Hendricks in the NATURALIST for June, imports into the "mechanics of soaring" a momentary force which I do not think improves it. There is no "momentary" force concerned with any part of the activity that I am aware of. The birds are in the air quite early in the morning, and continue there until nightfall, all the forces concerned in their movements being active every instant of the time.

The air pressures beneath the surface produced by the normal motion are constant, and the expansion of these pressures against the rear curve is constant, and this expansion gives the lateral motion. They are both derived from the gravitating force of the mass of the bird. There is no other force operative upon the bird in the act of soaring.

Mr. Hendricks answers my "crucial" question in the negative; for, "there is an unbalanced force which acts downwards, and parallel with the face of the plane, and therefore towards the rest." But when an equal force acting in the opposite direction is opposed to it, there is no longer an "unbalanced" force acting, for the force is then balanced, and the plane in equilibrium. While the plane is thus in equilibrium a force will move it with equal facility in either direction, for to suppose otherwise is to suppose a force active in one direction which is not active in the other, which is to deny the equality of the forces producing the balance.

Bear in mind that I have carefully excluded inertia, or in other words, mass acceleration, from the problem. The birds have the power of flapping; or falling from higher to lower levels, to initiate their movements. Soaring has nothing to do with acceleration. It deals with motions of uniformity only. Hence I am justified in holding that one or two pounds of constant pressure is competent to drive the plane edgeways 1000 feet per second against air friction only. As frictional air resistance approaches zero, a small force would move the plane against it with great velocity. No weight is lifted in the upward motion, as the forces producing the weight are already employed to their total value, as fully shown.

As the force producing the lateral motion is derived from the gravity of the mass, I am also justified in holding that a soaring bird is translated at right angles to the gravitating force, or horizontally, solely by the action of that force. It will be noticed that I have *assumed* the force derived from the rear expansion to be sufficient to give the lateral motion. When the wings of birds are examined the details of the lateral motion will be found. My concern in the "mechanism of soaring" was to show that the forces were on hand in quantity sufficient to produce the movement.—*I. Lancaster, Chicago, Ill., June 5th, 1886.*

LIMULUS IN THE PACIFIC.—My friend, Mr. H. W. Turner, of the U. S. Geological Survey, sends me an extract from the San Francisco *Evening Bulletin* of May 29th, which says: "A novelty on this coast was captured off the Farallone islands last Wednesday afternoon by Captain Camilio, who was fishing in his smack in that vicinity. Nothing like the crustacean had ever been seen on this coast before, and the fishermen thought they had made a capture that was valuable. It was found, however, that the prize was only a horseshoe crab, which is very common on the Atlantic coast. It is thought that the crab must have been hatched from eggs brought with the lobsters which were liberated in these waters seven or eight years ago."—*S. L.* [Can this have been the Japanese species ?—ED.]

THE SWIM-BLADDER OF FISHES.—Charles Morris has published in the Proceedings of the Philadelphia Academy, a theory of the origins of lungs and swim-bladder, and an explanation of their homologies and the peculiarities of their relative positions. He imagines that the primitive fishes, like the sharks, were without this organ, but that some of them, venturing on land for longer or shorter excursions, took in stomach and throatfuls of air, which procured a certain aëration of the blood. He imagines that the air held in the throat finally produced a distension of its superior wall, which became later a diverticulum and still later a sac with a narrowed opening. The tendency to rise when in the water would ensure that this bag of air should maintain its position above the œsophagus. In those fishes which continued to use air, as the Dipnoi, the sac became cellular and more complex. Its weight would then cause it to sink below the œsophagus, as we find it in Polypterus. From this stage the lung of air-breathers was derived. In those fishes which became most exclusively aquatic, the bladder underwent degeneration if it had acquired cells, and if not, remained a bladder only. In either case the loss of the connection with the œsophagus (ductus pneumaticus) is the final stage in this degeneracy.

This proposition of Mr. Morris is very plausible, and corresponds with the general course of evolution of the skeleton.

Dr. Paul Albrecht denies the homology of the lungs and swim-bladder in a pamphlet published by Carré, of Paris (1866). His reason is that the swim-bladder is on the dorsal side of the œsophagus, while the lungs are on the ventral side. He therefore regards the swim-bladder of Polypterus as a true lung, while that of Lepidosteus is a swim-bladder. In support of his view that these organs are respectively not homologous, he states that Diodon and Tetrodon possess both swim-bladder and lungs. The latter he recognizes in the diverticula from the lower side of the œsophagus, with which those fishes inflate themselves. He also sees a rudimental swim-bladder in diverticula from the superior side of the œsophagus which occur in some animals, for instance, in the pig.

THE FORMER SOUTHERN LIMITS OF THE WHITE OR POLAR BEAR.—In my remarks on the occurrence of the white bear in Labrador, where it is sometimes called the "water bear," in distinction from the black bear, which is very common on that coast, I then supposed that the polar bear was a straggler from Hudson's and Baffin's bays, rather by accident than otherwise, at rare intervals breeding so far south as Labrador. But on looking over the accounts of the early discoverers and navigators, as well as Cartwright's "Journal," I am led to materially alter my opinion and to suppose that the former limits of this creature extended even possibly as far south as Casco bay, on the coast of Maine.

Whether there are any notices of or references to the white bear in the records and sagas of the Norsemen who visited the coast of Newfoundland and Nova Scotia, we are unable to say. White bears were, however, seen by the first English navigator who discovered our shores, the intrepid Venetian, John Cabot, then sailing under an English flag. The following reference to white bears appears in an extract from an inscription on the map of Sebastian Cabot in Hakluyt's Voyages (III, 27):

"In the yeere of our Lord 1497 Iohn Cabot, a Venetian, and his sonne Sebastian (with an English fleet set out from Bristoll) discouered that which no man before that time had attempted, on the 24th of Iune, about five of the clocke early in the morning.

This land he called Prima vista, that is to say, First seene, because as I suppose it was that point whereof they had the first sight from sea. That Island which lieth out before the land, he called the Island of S. Iohn vpon this occasion, as I thinke, because it was discouered vpon the day of Iohn the Baptist. The inhabitants of this Island vse to weare beast skinnes, and have them in as great estimation as we have our finest garments. In their warres they vse bowes, arrowes, pikes, darts, woodden clubs and slings. The soil is barren in some places, and yieldeth litle fruit, but it is full of white beares, and stagges far greater than ours."

This account shows quite conclusively that John Cabot's Prima vista was some point of land in eastern or northern Newfoundland. The eminent geographer, Dr. J. G. Kohl, in his History of the Discovery of Maine, seems fully persuaded that the landfall of John Cabot was Labrador. But if the inscription and map are genuine, the description of the inhabitants of the island, both men and beasts, would better apply to those of the eastern or southern coast of Newfoundland. The human beings were more probably red Indians than Eskimo. On the Labrador coast the soil is "barren" in all places, while the "stagges far greater than ours" may have been the moose, which does not inhabit the Labrador coast. Whether the "white beares" were the polar bears or a pale variety of the barren-ground bear of Sir John Richardson is somewhat uncertain. We should have unhesitatingly referred the creature to the polar bear, were it not that in Parmenius' account of Newfoundland, published in 1583, it is said: "Bears also appear about the fishers' stages of the countrey, and are sometimes killed, but they seeme to be white, as I coniectured by their skinnes, and somewhat lesse then ours" (Hakluyt).

The next explorer of this coast was Cortereal who, in 1500, landed on the Newfoundland coast, at or probably near Cape Race. In an old Portuguese map of about the year 1520 is a long Latin inscription, thus translated by Kohl, a part of which we copy: "This country was first discovered by Gaspar Cortereal, a Portuguese, and he brought from there wild and barbarous men and white bears. There are to be in it plenty of animals, birds and fish." The land from which Cortereal brought the white bears was evidently the same as that in which he kidnapped fifty-seven of the aborigines. These were Indians and not Eskimo, and must have been the inhabitants either of Newfoundland or of Nova Scotia, for a person who saw them in the streets of Lisbon described them "as tall, well-built and admirably fit for labor." That however they were the aborigines of Newfoundland, perhaps Bethuks, seems proved by the fact that a number of white bears were also captured and sent to Spain with them. From these facts it seems reasonable to infer that the white or polar bear was a resident on the eastern coast of Newfoundland.

The next navigator to explore these seas was Jacques Cartier, who arrived May 10th, 1534, on the eastern coast of Newfoundland. To this observing seaman we owe our first accounts of the home of the great auk or "penguin" on the Island of Birds, now Funk or Fogo island, on the northeastern coast of Newfoundland; also of the Bird rocks of the Gulf of St. Lawrence.

While harboring at what is now Funk island Cartier, after describing the great auks, tells us that he saw a white bear. In his own language, done into quaint English by Hakluyt: "And albeit the sayd Island be 14 leagues from the maineland, notwithstanding beares come swimming thither to eat of the sayd birds: and our men found one there as great as any cow, and as white as any swan, who in their presence leapt into the sea, and upon Whitsun-monday (following our voyage towards the land) we met her by the way, swimming toward land as swiftly as we could saile. So soone as we saw her, we pursued her with our boats, and by maine strength tooke her, whose flesh was as goode to be eaten as the flesh of a calfe two yeres olde."

From this graphic and circumstantial account we feel sure that this was the great white or polar bear (*Ursus maritimus*); that it reached its full size, was not uncommon on the mainland (John Cabot says the land was "full" of them), and that it bred there, as those mentioned by Parmenius in 1583 were probably young ones.

The white bear is still occasionally seen on this coast, as Rev. Mr. Harvey states:[1] "The seal hunters occasionally encounter the white or polar bear on the ice off the coast, and sometimes it has been known to land."

Now, if in these early times of Cabot and Cartier the eastern coast of Newfoundland was the habitat and breeding place of the polar bear, it is not unlikely that it occasionally might have visited, as we know the walrus did, the coast of Nova Scotia and of Maine.

Our supposition is based on the following facts: In an ancient map of "New France," by the Italian Jacomo di Gastaldi, in about the year 1550, republished by Kohl, and which we here present of reduced size, what we should consider as veritable white bears are depicted as swimming in the ocean far from the coast of what must have been Nova Scotia, and near to but west of Sable island or "Isola della rena." In the map the bears are placed to the southward of "Terra de Nvrvmbega," which evidently comprised Nova Scotia and Eastern Maine. Sable island is an enlarged portion of a broad band, intended to represent the banks of Newfoundland and La Have.

That the animals represented are bears admits of little doubt; of the four figures the lowermost one is a seal; it is drawn without ears, while the three other figures have large, drooping ears, like those of a bear. At any rate, if the locality was put in at

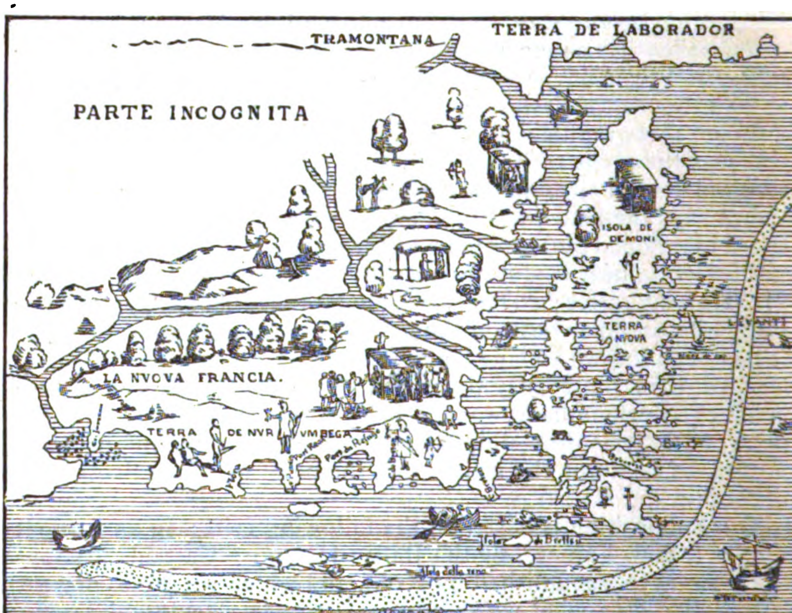
1 Halton and Harvey's Newfoundland, Boston, 1883, p. 193.

haphazard by the map-drawer, why should white bears be also represented, as they seem to be in the ocean off Isola de Demoni. The figures of the black bear, as well as of the rabbit and of the aborigines are well drawn, and it seems not unreasonable to infer that white bears were actually seen and reported to the south and west of Newfoundland.

That the white bear may have visited the coast of Maine, near Portland, is further proved by the probable discovery by Mr. E. S. Morse of a white bear's tooth in the shell heaps of Casco bay.

Speaking of the bones of the bear found in a shell heap on Goose island, Casco bay, Maine, the late Professor Wyman remarked in the AMERICAN NATURALIST, I, 575, January, 1868:

"The bones of the *bear*, though much less numerous, were



New France by the Italian Jacomo di Gastaldi in about the year 1550

similarly broken up, and in two instances had been carbonized by contact with the fire. Among the specimens collected by Mr. Muse in his first visit to Crouch's cove was the last molar from the lower jaw. The crown was somewhat worn, but the ridges were not all effaced; it was of small size, measuring 0.55 inch in length and 0.46 in breadth. The average size of eight specimens of the same molar in the black bear was: Length, 0.60 inch; breadth, 0.47, while that of two specimens from the polar bear was, length, 0.54 inch; breadth, 0.45. The tooth from the shell heaps, therefore, as regards size, more closely resembles the last-mentioned species, as it does also in the shape of the crown—but it must be unsafe from a single specimen of the molar in question to attempt to identify them. The former existence of the polar bear on the coast of Maine is rendered quite probable by the fact that the tusk of a walrus has actually been found at Gardiner."

That the white bear formerly was an inhabitant of Newfoundland seems probable from the facts we have brought together, and it is to be hoped that the antiquarians and naturalists of Newfoundland will investigate the shell heaps, should such be found, of that island for further facts bearing on this subject.

We will now turn our attention to the former presence of the white bear on the Labrador coast, where the settlers still call it the "water bear." We find only in Cartwright's Journal reference to this creature, but this is sufficient to show that it bred on and permanently inhabited this coast from Belle isle or Chateau bay northward. A white bear was killed in 1769 at Pitt's harbor, Chateau bay. There is a "White Bear Sound" on Cartwright's map just north of Cape Charles, near Battle island. Cartwright's house was to the northward of Cape Charles, in an arm of Sandwich bay. In 1770 Cartwright saw the track of two large white bears, and the Eskimo killed one the same year near his house. In April, 1772, the tracks of three white bears were seen. In April, 1776, a white bear and cubs were seen near Huntington island, and in the following May another was observed. White bears were also seen up the rivers leading into Sandwich bay, and on pp. 410–11 Cartwright describes the habits of the white bear in Labrador, stating that the young are born in March, the parent bringing forth usually one at a time, sometimes two.

While on the coast of Labrador in the summers of 1860 and 1864, we gathered what facts we could as to the occurrence of this animal, publishing them in the Proceedings of the Boston Society of Natural History (Vol. x, 1866, 270), from which we take the following extract:

"At Square island, a locality situated between Belle isle and Domino harbor, two cubs were captured and taken to St. Johns, Newfoundland. At Domino harbor the skin of a bear killed during the preceding spring (1863) was obtained by one of our party. An intelligent hunter told me that the white bear was not unfrequently seen at Stag bay, near Roger's harbor, which is situated a little more than fifty miles south of Hopedale. One was killed there during the preceding winter (1863), and in the autumn their tracks were abundant. They were very shy, and could not be seen in the daytime. Further south they are much rarer. The last polar bear said to have been seen in the Strait of Belle isle was shot fifteen years ago (1849), at the settlement of Salmon bay.—*A. S. Packard.*

Zoological News.—*General.*—A paper by Dr. Hans Gadow, upon the cloaca and copulatory organs of the Amniota, was read at the Royal Society on March 25th. The derivation of the sphincter and copulatory muscles from skeletal and visceral muscles was followed up in the Sauropsida and Mammalia, and the modifications of the cloaca in the chief groups of the Amniota were described. In the latter respect Hatteria comes nearest to the Amphibia, and Chelonia is intermediate between ostriches and crocodiles on one hand, and the Monotremes on the other. The peritoneal canals are still functional in crocodiles and tortoises, but rudimentary in Hatteria. Muellerian ducts are present in young male crocodiles and wolffian ducts in young females. The conclusion is that the whole cloaca consists originally of (1) the proctodæum, or outermost epiblastic anal chamber; (2) the urodæum, or hypoblastic middle chamber or primitive cloaca; and (3) the coprodæum, or innermost cloacal chamber. The urodæum is oldest, and the ventral urinary bladder, as well as the dorsal anal sacs (tortoises), are differentiations of it. The bursa tabricii of birds, various hedonic glands and the copulatory organs are derived from the proctodæum. The resemblance of these organs favors the phylogenetic connection of the Mammalia with the Reptilia.

Porifera.—The keratose sponges of the Challenger expedition have been described by N. Poléjaeff, of Odessa. Though not deep-sea organisms, thirty-seven species were collected, of which twenty-one are new.

Vermes.—Volume XII of the Challenger reports is on the Annelida Polycheta, and occupies over 550 pages. No less than 220 species are described as new. In many cases the food has been examined, and it throws some light on the food resources of the abyssal depths. A large number of forms occur in the North Atlantic. The remarkable new genus Buskiella is confined to the abysses, 2000 fathoms and more, of the Atlantic, but most of the genera are cosmopolitan. A great number of species were found at Kerguelen, the land-locked bays of which were rich in annelids. Australia and Japan furnished some peculiar and novel forms, while the North Pacific yielded but few species, and the majority of those of the South Pacific came from the Straits of Magellan. The greatest number of species were taken at depths under ten fathoms. Between 100 and 200 fathoms the number of species was less than between ten and 100 fathoms, but there were more new forms, and below these depths most of the fewer species found were new. Between 600 and 1000 fathoms, fourteen species were found, all new except two; depths between 1000 and 1200 fathoms yielded four species, all new; while between 1200 and 1500 fathoms more than twenty species were collected, only five of which were before known, most of them from shallower waters. Below this all the species found were new. The majority of the deep-sea annelids are tube-dwellers.——Only twenty-eight forms of Gephyrea were collected by the *Challenger*, with ten new species and no new genera. Forms before known as littoral were dredged from great depths. The strange male of *Bonellia viridis* with its curious segmental organs is figured.

Mollusca.—Some 500 species of lamellibranchs were collected by the *Challenger*. The greatest depth was marked by *Semele profundorum* and *Callocardia pacifica*, both found at 2900 fathoms in the North Pacific. The report by Mr. E. A. Smith forms Vol. XIII of the series.

Crustacea.—Mr. W. Faxon, in his revision of the Astacidæ (Mem. Mus. Comp. Anat., Vol. x. No. 4, Part I), enumerates fifty-two species of Cambarus and fourteen of Astacus. These genera compose the sub-family Potamobiinæ. The Astacidæ of the southern hemisphere form the sub-family Parastacinæ. All the species of Cambarus, with one exception, are American; but the Astaci occupy three well-separated areas. (1) Western North America; (2) Europe; (3) Eastern Asia and Japan.——The first part of M. F. E. Beddard's "Report on the Isopoda" of the Challenger expedition is occupied by the genus Serolis, of which sixteen species, nine of them new, were collected. Four of the species are deep-sea forms, while the remaining eighteen known kinds occur between five and 150 fathoms.——Fifty-seven species of Schizopoda, representing twenty-one genera, are described and figured by Prof. G. O. Sars in his report on the Schizopoda of the Challenger expedition. Forty-six of these are new. Prof. Sars regards these creatures as a sub-order of Decapoda, and recognizes four families: Lophogastridæ, Eucopiidæ, Euphausiidæ and Mysidæ. Nine species of Gnathophausia are described, one of them six inches in length. Twenty-three new species of Euphausiidæ are described, and post-embryonal stages of several genera are figured, showing that they are hatched as true Nauplii.

Birds.—One would believe that the habits of the European cuckoo are by this time well known, but Mr. Seebohm, in his History of British Birds, throws doubt on this, since he states that the usually received idea that the young cuckoo, soon after it is hatched, ejects the eggs or young of its foster parents, does not rest on a secure foundation. *Nature* puts against this the observations of Mr. J. Hancock, as recorded in the Natural History Transactions of Northumberland (1866). On January 17th, 1884, the nest of a hedge sparrow or hedge accentor, containing four eggs of the species, and one cuckoo's egg, was discovered. On the 27th the cuckoo's egg and two of the accentor's eggs were hatched. On the 28th, at 10.30 A. M., the cuckoo put one of the unhatched eggs out of the nest, and half an hour later it threw out one of the young accentors, the mother looking on quite calmly the while. At 1 it pushed out the second egg, and at

3.30 got rid of the second accentor. In this case poetical retribution was wrought, for while one of the turned-out accentors was placed in a white-throat's nest, and cared for by its foster parents, the young cuckoo was about a week afterwards found dead at the bottom of the nest.

Mammalia.—Dr. C. H. Merriam has reported to *Science* the discovery of an Aplodontia, show'tl or mountain beaver, which he believes to be sufficiently distinct from the ordinary form to take rank as a new species. Eight examples were taken in Placer county, Cal. The skull of this *A. major* is much larger and heavier than that of *A. rufa*, the occipital crest more highly developed, and the zygomatic arches more strongly convex. There are also differences in the color and pelage. A fœtal pigmy sperm whale (*Kogia breviceps*) has been received by the Smithsonian Institution. It is now proved that this species breeds in May.

EMBRYOLOGY.[1]

THE EARLY DEVELOPMENT OF JULUS TERRESTRIS.[2]—The eggs of *J. terrestris* are oval, white and covered by a thick chitinous chorion; the nucleus is embedded in a mass of protoplasm in the center of the egg. This central mass of protoplasm is irregular in shape, but its long axis corresponds with that of the egg. From it anastomosing processes radiate in all directions, forming a network throughout the egg, in the meshes of which the yolk-spherules are contained. The nucleus is not a distinct vesicle, but its position is marked by chromatin granules, and there is no nucleolus.

On the second day the nucleus and central mass divide into two parts, but this division is not complete, the two resulting masses with their nuclei remaining connected by a network of protoplasm. The two segments then again divide in the same incomplete manner, so that there are now four segments connected together. On the third day the formation of the blastoderm begins, some of the segmentation masses making their appearance on the outside of the ovum at different points, so that the development of Julus resembles that of Geophilus as worked out by Sograf. The cells in the interior of the yolk are the direct descendants of the first segmentation masses, and constitute the hypoblast.

The fate of the hypoblast cells is various; some are employed in the formation of the mesoblastic keel, that is, in the formation of the splanchnic and somatic mesoblast. Another part gives rise to the hypoblast of the mesenteron, and a third portion remains in the yolk after the mesenteron is formed, and gives rise to mesoblast cells which are employed in the formation of various muscles and the circulatory system.

[1] Edited by JOHN A. RYDER, Smithsonian Institution, Washington, D. C.

[2] F. G. Heathcote, M.A. Proc. Roy. Soc. London, Vol. XL, No. 242, pp. 73–76. (Read Jan. 21, 1886.)

With regard to the retention of the primitive union of the cells of the ovum until this stage, nothing of the sort has been described before, except by Sedgwick in Peripatus. The most important part, it seems to me, is not the connection of cell to cell, but of layer to layer by means of processes of the cells.

About the middle of the fourth day several of the hypoblast cells approach the epiblast in the middle line of what will eventually be the ventral surface of the embryo. This is the beginning of a mesoblastic keel such as Balfour described for Agalena.

The epiblast cells in the ventral middle line, after altering their shape, increase by division and take a considerable share in the formation of the keel. The hypoblast cells below them also increase, and on the fifth day the mesoblastic keel is complete, in the formation of which both epiblast and hypoblast have taken part. The keel is still present on the sixth day, but the cells composing it are becoming elongated in a plane parallel to its surface. They then spread out to form two definite splanchnic and somatic layers of the mesoblast below the epiblast. These two layers are connected. The keel disappears on the seventh and eighth days, and on the ventral surface the epiblast cells assume a columnar form, thus giving rise to the ventral plate.

The mesoblast now becomes thicker on each side of the median line, both layers being concerned in this thickening, where they become indistinguishable. Outside the thickenings, that is, farther away from the middle line, the two layers are closely applied to each other and to the epiblast, as before. It thus results that the mesoblast is mainly arranged in two parallel longitudinal bands along the ventral side, these bands being connected across the middle line by a thin portion consisting of a single layer.

These bands now begin to be segmented into mesoblastic somites from before backwards, their position corresponding with that of the future segments of the body. There are at first eight somites, corresponding with the eight segments of the embryo when hatched. These somites are at first solid; afterwards a cavity appears in them.

Early on the ninth day the stomodæum is formed as an invagination of the epiblast near one end of the ventral surface. Shortly after the formation of the stomodæum the proctodæum appears as a shallow somewhat wide invagination of the other end of the ventral surface.

The body segments now become more apparent, each being marked by a deep transverse furrow in the epiblast. The hypoblast cells are still present within the yolk, but are gradually becoming collected in the median line, just below the mesoblastic bands. The stomodæum and proctodæum become more deeply invaginated, extending a considerable distance into the yolk, and at the same time the hypoblast cells begin to form the mesenteron, arranging themselves around a central lumen.

On the tenth day the ventral flexure is formed by a deepening of the transverse furrow between the seventh and eighth segments. As this furrow deepens and the embryo increases in size, the last segment grows in length. At the same time the embryo curves round toward the ventral surface, the end segment being bent round against the head. The eighth segment is longer than the others except the head. Even as late as the twelfth day, when the nervous system is far developed in other parts of the body, in the eighth segment the tissues are imperfectly differentiated, the nerve cords not showing any ganglia, but lying on the epiblast and not quite separated from it. At a later period of development the anal segment is constricted off from the eighth, while from the anterior part of the latter, the additional segments formed in the course of development are derived. These additional segments are therefore intercalated between the seventh and ninth.

Just before the appearance of the ventral flexure the embryo develops a cuticular envelope over the whole surface of the body. This is the so-called amnion of Newport. Just before the formation of the ventral flexure the nervous system is formed. The first traces of this consist in a thickening of the epiblast on each side of the middle line; this is soon followed by the formation of a shallow furrow between the thickened parts; this longitudinal furrow corresponds with that described by Metschnikoff in Strongylosoma.

The bilobed cerebral ganglia are formed first, and the nerve cords are formed from before backwards, a pair of ganglia being present for each segment except the last. The posterior portion of the nerve cords is completed at a considerably later stage of development. The nerve cords are widely separated, but are connected by a thin median portion. In later embryonic life they are closely approached to one another, and almost form one cord.

On the eleventh day the embryo has increased considerably in size. The ventral flexure is complete, and the animal lies with the long end segment folded closely against the rest of the body, the end of the tail being against the stomodæum. The nervous system is now completely separated from the epiblast, and the epiblast has assumed the adult form. It now separates a second membrane like that which is formed on the tenth day.

The splanchnic layer of mesoblast covers the mesenteron, the stomodæum and proctodæum.

Within the yolk, which is still present in great quantity in the body-cavity, there are present a number of hypoblast cells. These, as has already been mentioned, give rise to the circulatory system and to various muscles. They may, therefore, be now considered as mesoblastic cells which have been directly derived from the hypoblast.

On the twelfth day the Malpighian tubes are formed as blind outgrowths of the proctodæum, the nervous system is further developed, and the first rudiments of the appendages begin to appear. Late on this day the animal is hatched with only the rudiments of its appendages.

An investigation of the development of Geophilus by Sograf[1] shows that the early cleavage of the egg of Chilopods is very similar, not only that, but even the formation of the mesoblastic bands and cœlomic cavity is similar. Great numbers of cells also remain in the yolk in this form until a late period and apparently migrate outwards, and may possibly take a share in forming certain mesoblastic structures. There is, however, no evidence to show that the yolk lies immediately within the body-cavity in either Geophilus or Lithobius, but rather within the mesenteron, so that in this respect the Chilopods differ pretty widely in their development from the Diplopods, as described by Heathcote. It may be that the splanchnic mesoblast may indirectly acquire accessions of cellular elements from the underlying walls of the mesenteron, even in the Chilopods, but of this there is no very clear evidence, except in the case of one of Sograf's figures. The Malpighian tubes develop in the same manner in Geophilus as in Julus; and, while there is no clearly defined anal segment developed as in the latter, the somites are formed from behind forwards between the first-formed segments and the terminal section of the body, where the proctodæum is invaginated. The wall of the mesenteron is the last structure from which the yolk-spherules disappear in the Chilopods, and finally the lumen of the mesenteron appears surrounded by a second nearly homogeneous investment of yolk which lies within the hypoblastic wall of the mesenteron, and in which free multipolar cells are embedded. There occurs a dehiscence of cells into the cœlom from the splanchnic mesoblast investing the mesenteron. These free cells represent blood cells. The process is somewhat analogous to that observed in embryo fishes, in which blood cells are freed from the periblast of the yolk, the periblast, though undoubtedly occupying the position of the hypoblast, has, on account of the peculiar way in which the yolk is finally excluded from the ventral side of the intestine, taken up the position of a splanchnopleure in relation to the somatopleure, which covers not only the viscera but also the yolk, so that the latter in fishes may be considered to be intraäbdominal, since the periblast or what represents the splanchnopleure, at least in part, is in many cases a transitory structure, leaving no trace of itself in later embryonic life. Were the lumen of the intestine, however, to originate in

[1] In contributions from the Laboratory of the Zoölog. Museum in Moscow, Vol. II, 4to, 1883. (In Russian.)

the same way in fishes as in Myriopods, viz., as a direct canalicular vacuolization of the yolk passing through its central longitudinal diameter, the periblast would doubtless then represent the hypoblast or what it did in very primitive fish-like forms, while externally it would have been covered by a true splanchnopleure which had been developed in advance of the permanent hypoblast of the mesenteron, though the latter had been primarily derived from the primitive hypoblast.

The eggs of the Myriapoda, it is to be remembered, represent a very peculiar type, that is, they at first have the germinal matter concentrated in the center, but as development proceeds the germinal matter, after segmentation into a number of cells, is repelled centrifugally or to the outer surface of the ovum. The primary segmentation therefore occurs in the center of the egg and not at one side or superficially until some progress in segmentation has been made at the center of the egg. This probably characteristic mode of development seems to distinguish, in a measure, the Myriapoda from other Arthropoda, since in no other arthropodous form does the vitellus so constantly occupy a superficial position and so completely invest the first segmentation cells, which are then aggregated in a cluster at the center of the egg.

The Development of Agelena nævia.[1]—In the memoir, the place of publication of which is here cited, William A. Locy has very carefully worked out the development of the spider (Agelena), and obtained a number of new and important morphological results. He finds that there is at first a peripheral layer of protoplasm present, and that the nucleus of the first segmentation is central and imbedded in plasma. This first nucleus subdivides and gives rise to new nuclei, each invested by plasma. These migrate to the periphery of the egg and appropriate the peripheral layer of protoplasm or "blastema." In this way a hollow blastoderm is formed. Just before the primitive cumulus is formed a depression appears at the point where the latter develops, and it appeared not improbable that this depression represents the first portion of the blastoderm of the spider's egg which becomes invaginated. Later, and about 80° from the primitive cumulus, a second thickening appears in the blastoderm; this second thickening spreads rapidly and becomes shield-shaped. Between the two the intervening blastoderm then becomes thicker, thus leading to the development of the ventral plate.

The protozonites or first indications of somites are then formed from the cephalic and caudal plates. Two somites arise from the former and they bear the chelicerae and pedipalpi; the other somites develop from the caudal plate, and give rise to the ambulatory and rudimentary pairs of appendages. The embryo still presents a transversely banded appearance in the third as in

[1] Bull. Mus. Comp. Zoölogy, XII, No. 3, 1886, pp. 63–103, Pls. 12.

the preceding stage. Sections show that the cavities of the limbs are prolongations of the cavities of the corresponding mesodermic somites. The nervous system at first consists of two rows of ganglia, one to each somite; these are widely separated in the middle line, except in the head and tail lobes, where those of opposite sides are fused. The stomodæum arises as an invagination between the ganglionic thickenings of the cheliceral somites, and immediately below the ventral margin of the cephalic plate.

About the time that the ventral flexure appears, or when the embryo becomes folded upon itself, the proctodæum, heart, lungs, trachea, spinning glands and muscles develop. The cheliceræ and pedipalpi appear as postoral structures, but in the course of further development they appear as preoral appendages. At an early stage the proctodæum is enlarged by the outgrowth of its dorsal wall; from this diverticulum the so-called stercoral pocket of the adult is formed. The lateral nerve cords are finally approximated in the middle line, and the posterior or abdominal portion of the nervous system degenerates. The poison glands appear as groups of enlarged cells at the bases of the cheliceræ. The spinning glands develop from the ectoderm in the anal region on the ventral side of the proctodæum. The lungs arise as infoldings from a large oval pair of masses of cells, the nuclei of which are arranged in parallel lines. From these cells the lamallæ of the lungs are formed. The heart remains open below for a time, communicating freely with the yolk. The aorta, at a later period, is constricted off from the mesenteron. At least two pairs of the provisional appendages on the abdomen are modified into the spinning mammillæ. The remnant of the upwardly flexed tail persists for some time as a postanal knob; its tip represents the morphological end of the body.

The eyes are developed as invaginations of the ectoderm (hypodermis). The retinal involution becomes constricted off from the ectoderm entirely, and then lies just below that portion of the hypodermis which afterwards becomes the vitreous body. In a concave depression, on the surface of the latter, the lens arises as a lenticular thickening of the cuticula. The mode in which the light traverses the eye is essentially similar to the method in which the light reaches the percipient elements of the retina in the vertebrate eye.

Embryology of Armadillos.—It is a belief among the people of South America that armadillos bring forth only male young. Dr. von Ihring, of San Paolo, communicates to *Cosmos* some important observations he has made on this and other points in the history of the development of the armadillo *Praöpus hybridus*. He states that all the fœtuses taken from two females presented the external characters of males only. He also states that several fœtuses—six or more—are enclosed in a single chorion, which is surrounded by as many zonary placentæ as there are fœtuses, the placentæ not, however, forming perfect zones. He finds the ungual phalanges at this period to differ entirely from that of the adult. Instead of being long and claw-shaped, they are wide and hoof-shaped, with a trilobate margin, as in the extinct genus Gyptodon. This is highly interesting as exhibiting the law of acceleration modifying that of heredity. The sexual characters are probably like those of the hyænas, in that the female fœtus has a clitoris so large as to give her a close resemblance to the male.—*E. D. Cope.*

PSYCHOLOGY.

GAMBETTA'S BRAIN.—The *Revue* recently (November 21st, 1885) gave the weight of Gambetta's brain, according to M. A. Bloch. This weight, which was remarkably light (1160 grammes), evidently ought to be considered as an entirely secondary element in a proper estimate of the diverse qualities of the organ. At a recent session of the Society of Anthropology (March 18) Professor Mathias Duval communicated a very interesting report in which he brought out and gave their due value to certain structural details of this brain—to certain characteristic elements which must be regarded as far outweighing the simple consideration of the gross weight of the organ. Compared with the brains of individuals known to have been possessed of but little intelligence, and representing types of reduction of the third frontal convolution, the brain of Gambetta, besides other peculiarities, shows a type of extreme development of that convolution. This development is such that not only are the secondary convolutions more numerous and more complicated than those of ordinary brains, but, besides this, the "cape" is double.

This development is evidently in favor of the localization discovered by Broca, who held that the third frontal convolution was the seat of speech. M. Mathias Duval has also pointed out the two following peculiarities, the significance of which he has not been able to determine.

(1) The right quadrilateral lobule is very complicated, and is divided into two parts by a sulcus which starts from the occipital fissure. The lower of these two parts is subdivided into many secondary convolutions by the presence of a fissure with numerous branches arranged in star-like patterns.

(2) The occipital lobe is notably reduced, especially upon the right side.

M. Mathias Duval thinks therefore that Gambetta's brain should be considered refined (*beau*)—although the expression does not appear to him scientific—in the sense that it preserves, especially in the frontal region, in spite of the complication of its folds, a regularity which may be called schematic.—*Revue Scientifique, April 3d, 1886, p. 444.*

Memory in the Humble Bee.—The author removed a nest containing numerous individuals of one of the common humble bees (*Bombus terrestris*) from its original location, and carried it to his residence, about three miles distant. He further carefully watched the place for some time after having captured all those that had flown to the defence of their nest, and secured, it was believed, the entire colony. These he imprisoned for several hours in a wide-mouthed bottle, and safely reunited them in their new home. At his house he placed the nest, with its inhabitants, near a window, and after they had become quieted, made a small entrance. Immediately they began to fly out, and in doing so must have observed their surroundings, for in a short time they one by one returned. The following night, however, there was a severe storm, and while the inhabitants of the forty other colonies near it, that had not become accustomed to their surroundings, were not in the least troubled, these bees escaped, and hid themselves somewhere without during the storm. Upon searching for them early the next morning, the queen was found dead upon the ground, while fifty or sixty of the workers were seen flying about the house. From time to time one or another—probably those which had flown out of the entrance the day before—found the opening and returned into their nest, while the remainder after flying about for several hours gradually disappeared, till not one was left. As it was supposed that they had in all probability returned to their previous nest, the place was visited in the afternoon, where, sure enough, at least fifty individuals were found. They had thus, it will be seen, distinctly remembered it, and after they had sought in vain to find entrance to their new home, they had depended upon their wonderful sense of locality, and returned thither.

A similar instance was observed with another nest, which had been removed a distance of nearly five miles, and in which the same care had been exercised to capture all the individuals. In unskillfully handling the box containing the nest and bees, in its new location, about thirty of the workers escaped, and flew through the open window. After flying for a long time about the house, as though in search of their comrades, they likewise disappeared and returned to their original nest, and again established themselves, as was afterwards ascertained.

It was frequently observed that, when nests have been removed but a short distance, the workers during the first few days after their change, would fly swiftly in the direction of their old nest, when, discovering their mistake, they would change their course, and go to their new home. It seemed evident that these little creatures, through some mental process or other, thus discovered their changed circumstances.

In order to test further this remarkable sense of locality, the author marked a number of individuals with oil colors, and carried them, enclosed in wooden cases, a distance of eight or nine miles, when he allowed them to escape. Very many of them, though not all, found their way back to their nests, and as a rule reached home sooner than the author did himself.

The author noticed that at his summer residence, where he had kept numerous hives of these bees, the following spring many individuals appeared, and seemed to be searching for their previous nests; but he was unable to determine whether they were individuals of the previous broods or not. Towards the close of July, 1884, he obtained three nests of *Bombus mastrucatus*, a large species only found in the mountains, and especially the higher regions, and carried them to his residence in the city, where he placed them in a window of the second story. The house was enclosed by high buildings, with no garden attached, and yet they returned readily and directly from their excursions to their nests.

They throve, and by the first of October had increased to considerable numbers. By the middle of October they wholly disappeared; but in the early part of the following April, individuals of this species were observed flying about the window, and as soon as they found an entrance, sought the remains of their old nests, and took up their abode. They remained for a while, when their nest was accidentally injured, and they left. Nothing more was seen of them till after the author's return from his summer vacation, in the middle of September, when a single female of this species made its appearance. In their inability to obtain an entrance through the closed window, they had evidently built a new nest in the vicinity, and reared their broods.

These circumstances indicate that the intellectual powers of the humble bee are not as slight as we have been accustomed to believe. Here in this case, from October to April—a period of six months—had these bees remained dormant in the ground, or hidden in some crevice, and, upon regaining their activity, had not only remembered the place where they were, but had sought and found, despite the many difficulties, their last year's nest. That these individuals were from last year's brood, there was no doubt, as throughout the province the species nowhere else occurs, peculiar as it is to elevated and mountainous regions.

The foregoing is from *Science*, April 9th, 1886 (translated from *Kosmos*), but we do not agree with the statement that the brain of the bee is simple; on the contrary it is only less complex than that of a fish.

THE VISION OF BIRDS.—I have been exceedingly interested, while watching the wrens, robins, and blue-birds at the time they are rearing their young broods, to note the celerity of their movements and the evident acuteness of their vision. They are able to see an insect much further than a person can distinguish one, and fly as straight as an arrow to the minute object when it is from fifteen to thirty feet distant. They seem to make no mistakes, but always to secure the coveted prey. I have often seen these birds dart down *into the grass* from those heights and seize an insect with such precision that it must have been plainly visible from where the start was made. This would indicate that they possess a faculty of sight, developed by ages of practice, altogether above that of the human race, and most useful in their struggle for existence. But the late Robert Kennicott (quoted by Baird, Brewer and Ridgway in their great work on the Birds of North America) states that a pair of a wrens will capture 1000 insects per day during the breeding season, and this fact of itself would indicate the sharpest vision and wonderful celerity of movement.—*Charles Aldrich, Webster City, Iowa, June 1st, 1886.*

ANTHROPOLOGY.[1]

THE DAVENPORT ACADEMY has just issued Vol. IV of its Proceedings, nearly the whole of which is occupied with anthropology. The papers of Dr. Hoffman and Mr. Holmes have been some months in print and have been previously noticed. An appendix of nearly one hundred pages is by the president of the academy, and entitled "Elephant pipes and inscribed tablets in the museum of the Academy of Natural Sciences, Davenport, Iowa." The contents of this appendix may be tabulated as follows:

1. A defence of the separate nationality of the Mound-builders against the theory of their identity with modern Indians.
2. A defence of the genuineness of the three inscribed tablets and two elephant pipes in the museum of the Academy, especially against the statements of Mr. Henshaw in his paper published in the second annual report of the Bureau of Ethnology and the endorsement of the director of the bureau.
3. An argument against centralization of ethnological work in the Smithsonian Institution and the Bureau of Ethnology.
4. A series of letters from friends of the Davenport Academy in sympathy with a former vindication.
5. Extracts from scientific journals in relation to the same subject.

Whether the Mound-builders were succeeded in the Mississippi valley by their immediate descendants, the Indians living there when the whites made their appearance three centuries and more ago, is an open question, though some archæologists have declared the argument closed. Dr. Carr, Dr. Brinton, the director and the archæologist of the Bureau of Ethnology, and many others are in favor of the identity. Squier and Davis, President Putnam and many other eminent archæologists hold the contrary view, maintaining that the Mound-builders exhibited traits of civilization which set them far above their modern successors on the same soil. The appendix to the Davenport Proceedings is an able summary of the arguments in favor of the higher civilization of the Mound-builders. It seems to us that a comprehensive review of what can be said for and against this theory by some judicial mind would be exceedingly timely.

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

Upon the second point we can throw no additional light. The Davenport Academy is one of the most thriving State associations for research and collection of material. In some particulars the museum vies even with that of the Smithsonian Institution. There are in all this vast treasure five objects which run the whole gamut of reputation, from that of base fraud to the highest credibility. President Putnam gives the history of their acquisition as follows:

a. The discovery of two inscribed tablets in Mound 3, on Cook's farm, near Davenport, by Jacob Gass, L. H. Willrodt and H. S. Stolzenau, with five other persons, Jan. 10, 1877.

b. The discovery of another tablet, Jan. 30, 1878, in Mound 11, on Cook's farm, by Jacob Gass, John Hume and Charles E. Harrison.

c. The discovery, in March, 1880, of an elephant pipe in a mound on Hass' farm, in Louisa county, Iowa, by A. Blumer, Jacob Gass and F. Hass.

d. The obtaining of an elephant pipe by Jacob Gass from a farmer in Louisa county, Iowa, who found it on his farm while planting corn.

In reply to the assertion that these pieces are not genuine, Mr. Putnam enters the most eloquent protest, backed up by Farquharson, Pratt and J. D. Putnam, who were familiar both with the finders and the finds. President Putnam commits himself to belief in the contemporaneity of man and the mastodon in America, invoking the testimony of Koch, Dickson, Pourtales, Dowler, Winslow, Whitney, Cleu, Hilgard and Fontaine. This contemporaneity is again a subject open to discussion, and no doubt it will receive the attention which it deserves.

The third part of President Putnam's argument, in which the Smithsonian Institution and the Bureau of Ethnology are held to be antagonistic to local societies of our country, ought to have been omitted. Ninety-one pages of the volume containing Mr. Putnam's argument were contributed by Dr. Hoffmann and Mr. Holmes of the Bureau of Ethnology. On page IV it is distinctly stated that Dr. Hoffman and the Bureau of Ethnology furnished all the illustrations for these papers without expense to the academy. On p. 245 we are told that "the special thanks of the academy were tendered to Major Powell for his courtesy in lecturing, free of charge, for its benefit."

The writer of this note, long before his connection with the National Museum, was familiar with the intense desire of Professor Baird to foster local scientific organizations. He also, at Major Powell's request, sat for several days on a commission to nominate anthropological societies and students throughout the world to receive all the publications of his bureau, in order to place them where they would do the most good. It would be an irreparable loss to anthropological science if by any means this bureau should be disestablished before Powell, Pilling, Mallery, Thomas, Henshaw, Dorsey, Gatschet, Cushing, the Mindeleffs, Hoffman, Yarrow, Boas, Murdoch shall have finished the great work which each has undertaken, and any one of which would be far too burdensome for any scientific association in America to carry.

VOCABULARY OF ARCHERY.—In a former number of the NATURALIST Mr. John Murdoch kindly furnished us with a vocabulary of the harpoon. We give below a vocabulary of archery, hoping that all who are in sympathy with us in establishing accurate nomenclature for the various branches of anthropology will aid in adopting these terms, or at least will state their objections if they have any. No claim whatever is made to originality in most of the terms. Dr. John Evans, the Encyclopædia Britannica, Professor Morse, Mr. Murdoch, Hansard and others have been freely consulted. The list of words given below includes the bow, the arrow and the arrow-maker's outfit. No discrimination is made between ancient and modern archery, as it is designed to include the whole life-history of this species of human activity in the same manner that a zoölogist would monograph species of animals:

ARCHER, old French *archier*, Latin *arcarius*, from *arcus*, a bow, one who shoots with a bow; whence archery, shooting with the bow.

ARM-GUARD. The Japanese, in releasing, revolve the bow in the left hand; a guard is worn on the outer side of the forearm to catch the blow of the string.

ARROW, a missile shot from a bow. The possible parts are the head, barb-piece, foreshaft, shaft or stele, feathering, nock, and seizings.

ARROW CEMENT, substance used in fastening the arrow-head to the shaft. A few tribes use glue or cement in making the sinew-backed bow.

ARROW-HEAD, the part of an arrow designed to produce a wound. The parts of the primitive stone arrow-head are the tip or apex, faces, sides, base, shank or tang, and facets.

ARROW-STRAIGHTENER, a piece of bone, wood or ivory with a perforation to serve as a wrench in straightening arrow-shafts, barbs, etc.

BACK (side), the part of the bow away from the archer.

BACKED, a bow is backed when along the outside are fastened strips of wood, sinew or cord to increase the elasticity.

BALDRIC, the strap supporting a quiver or sheath, being worn over one shoulder, across the breast and under the opposite arm; generally much ornamented.

BARB-PIECE, the piece of ivory, &c., on some arrows attached to the true head and having barbs on the sides. This should be carefully discriminated from the foreshaft, which has another function altogether.

BASE of an arrow-head, the portion which fits into the shaft.

BELLY (inside), the part of a bow toward the archer, usually rounded.

BOW, an elastic weapon for casting an arrow from a string. (See self-bow, compound bow, backed bow, grafted bow.)

BOW-CASE, a long bag of wood, leather or cloth, in which the bow is kept when not in use.

BOW-STAVE, the bow in a rough state. Bow-staves were an important item of commerce prior to the use of gunpowder.

BOW-SHOT, the distance to which an arrow flies from a bow.

BOWSTRING, the string used in discharging a bow. The substances used, the method of treatment and of nocking are important to notice.

BOW-WOOD, the substances used for bows, generally wood, but horn, antler, bone and metal have been employed.

BOWYER, a maker of bows.

BRACER (wrist-guard), a contrivance for protecting the archer's wrist from being galled by his bowstring.

BRACING (stringing), bending the bow and putting the eye of the string in the upper nock preparatory to shooting. The different methods of bracing throughout the world form an interesting study.

BUTTS, pyramidal banks of earth used formerly for targets.

BUTT-SHAFT, a blunt arrow for shooting at a butt, the ancient style of target.

CHIPPER, the pointed implement of bone, antler, &c., used for shaping flint arrow-heads, spear-heads, &c.

COCK-FEATHER, that feather of an arrow which is uppermost when the bow is drawn.

COMPOUND BOW, made of two or more pieces of wood, bone, horn, antler, lashed or riveted together.

EYE, the loop of a bowstring which passes over the upper nock in bracing.

FACES, the broad, flattened portions of an arrow-head.

FACETS, the little surfaces left by chipping out a stone arrow-head.

FEATHERING, the strips of feather at the butt of an arrow, including the method of seizing or fastening.

FLAKING HAMMER, called also hammer stone, a stone used for knocking off flakes in making flint arrow-heads, &c.

FLETCHER, an arrow-maker, akin to *fleche.*

FOOTING, a piece of wood inserted in the shaftment of an arrow at the nock.

FORESHAFT, a piece of hard wood, bone, ivory, antler, &c., at the front end of an arrow to give weight and to serve for the attachment of the head.

GRAFTED BOW, a species of compound bow formed of two pieces joined together at the handle.

GRIP, the part of a bow grasped in the hand. The same term should be applied to the corresponding part of swords, daggers, &c., where it is differentiated in any manner.

GUARD (wrist-guard), a shield of leather or other substance fastened to the wrist of the left hand to prevent injury from the bowstring (see bracer).

HORN, the end of a bow when made of horn.

LIMBS, the part of a bow above and below the handle or grip.

NOCK, properly the notch in the horn of a bow, but applied also to the whole of that part on which the string is fastened. Upper nock, the one held upward in bracing. Lower nock, the one on the ground in bracing. Also the notch in the end of an arrow.

NOCKING, placing the arrow on the string preparatory to shooting.

NOCKING-POINT, that place on a bowstring where the nock of the arrow is to be fitted, often whipped with silk.

NOOSE, the end of a string which occupies the lower horn of a bow.

OVER-ARROWS, those shot directly over the center of the mark and beyond the target.

OVERHAND, shooting overhand is to shoot at the mark over the bow-hand, when the head of the arrow is drawn inside the bow.

PACKING, of leather, fish-skin or other soft substance used in binding the nocks and the grip of bows.

PILE, the head of an archery arrow; any arrow-head may bear the same name, in which we may have a one-pile, two-pile, three-pile arrow, &c.

PITCHING-TOOL, or knapping-tool, a column of antler or other hard substance used between the hammer and the core in knocking off flakes of stone.

RELEASE, letting go the bowstring in shooting. Professor E. S. Morse characterizes the various releases as follows:

1. Primary release, thumb and first joint of forefinger pinching the arrow nock.
2. Secondary, thumb and second joint of forefinger, middle finger also on string.
3. Tertiary, thumb and three fingers on the string.
4. Mediterranean, fore and middle finger, thumb not used.
5. Mongolian, thumb on string, with or without thumb-ring.

RIBAND, a term applied to the stripes painted on arrow-shafts, generally around the shaftment. These ribands have been called clan-marks, owner-marks, game tallies, etc.

SEFIN (see thumb-ring).

SELF-BOW (simple), made of a single piece of wood or other material.

SHAFT, anciently an arrow, but strictly the portion behind the head, and in a fore-shafted arrow the lighter portion behind the foreshaft.

SHAFT-GROOVES, furrow cuts along an arrow-shaft from the head backward; they have been called blood-grooves and lightning-grooves, but these names are objectionable as involving theories.

SHAFTMENT, the part of an arrow on which the feathering is laid.

SHANK, the part of an arrow-head corresponding to the tang of the sword-blade.

SHORT-ARROWS, those which fall short of the mark.

SIDES, of an arrow-head, the sharpened portions between the apex and the base, also called the edges.

SINEW-BACKED BOW, one whose elasticity is increased by the use of sinew along the back, either in a cable of twine, as among the Eskimos, or laid on solid by means of glue, as with many tribes in Western United States.

SLEIGHT, the facility with which an archer releases his bowstring.

STELE (stale, shaft), the wooden part of an arrow, an arrow without feather or head.

TARGET, a disk of straw covered with canvas, on which are painted concentric rings, used in archery as a mark in lieu of the ancient butt.

THUMB-RING, a ring worn on the thumb in archery by those peoples that use the Mongolian release; called sefin by the Persians.

TIP, a term applied to the sharp apex of an arrow-head.

TRAJECTORY, the curve which an arrow describes in space, may be flat, high, &c.

WEIGHT, of a bow, the number of pounds required to draw a bow until the arrow may stand between the string and the belly, ascertained by suspending the bow at its grip and drawing with a spring scale.

WHIPPING (seizing, serving), wrapping any part of a bow or arrow with cord or sinew regularly laid on.

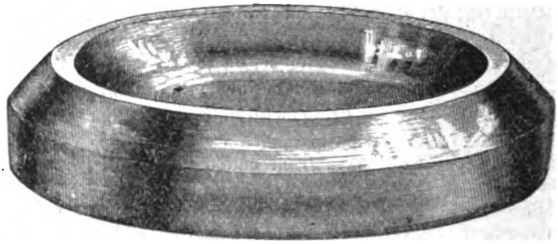
WIDE-ARROWS, those shot to the right or the left of the mark.

MICROSCOPY.[1]

A STAINING DISH.—A convenient form of staining dish has hitherto been a desideratum; at my request the Educational Supply Co., at 6 Hamilton place, Boston, has undertaken to supply this desideratum. The new dish, shown of the natural size in the cut, is made of clear glass with polished surfaces; it is sufficiently deep to hold a considerable quantity of fluid, while the curves inside are such that although large sections lie nearly flat, yet

[1] Edited by Dr. C. O. WHITMAN, Mus. Comparative Zoölogy, Cambridge, Mass.

when very little fluid is used it gathers into the center. The dishes, owing to their vertical sides, are readily stacked, while



the bevel is wide enough for a label, which can be easily seen both when the dishes are stacked and as they set upon the table singly. They are sold at $2.50 per dozen.—*Charles S. Minot.*

——:o:——

SCIENTIFIC NEWS.[1]

— The new museum building of Columbia College, New York, devotes its first floor to chemistry, the second to mineralogy and metallurgy, the third to archæology and geological conference, the fourth to engineering and museums, the fifth to geology and palæontology. The building runs from 49th to 50th street, forty feet wide, with lecture-rooms adjoining each museum. The library has been arranged and catalogued, and is lighted by electricity. The astronomical observatory over the library, in charge of Professor J. K. Rees, has been equipped with telegraphic apparatus and a thirteen-inch equatorial telescope, costing $20,000, given by Louis M. Rutherford, which is used for lunar researches. The herbarium has extensive rooms, and is one of the largest and most valuable in the country. The geological museum, under Dr. J. S. Newberry, has been rearranged and provided with new cases, and is now displayed at the best advantage. The table cases are ten by four feet in size, and completely filled with mineral ores and products, making the most varied collection of the kind extant. Fifteen wall cases are filled with minerals and building stones. The palæontological collection is arranged in twelve table and sixteen wall cases to the best advantage for instruction. Here also cases containing numerous specimens of rocks and the minerals which make rock, as auxiliary to the study of lithology. There is a large collection of animals illustrative of the different groups bearing on the study of palæontology. Among the recent additions are specimens of fossil Saurians from the Jurassic rocks of Würtemberg, representing the Ichthyosaurians and Teleosaurians; a fine speeimen of the cave-bear, etc.

[1] Edited by Wm. Hosea Ballou, 265 Broadway, New York.

— There is some hope of having a Division of Ornithology and Mammalogy created in the Department of Agriculture. Professor Riley and Dr. Merriam recently appeared before the Senate sub-committee on appropriations having in charge the agricultural appropriation bill, and urged an amendment to the House bill creating such a division and appropriating $15,000 therefor. Our readers are aware that ornithological work was begun last year under the Division of Entomology. It was added to Riley's others duties against his wish, and he deserves the thanks of ornithologists for carrying out the wishes of the Ornithological Union in appointments made under him. He realizes that there is much in economic ornithology which has no bearing on entomology, and if the new division is created, Professor Riley and Dr. Merriam have arranged that the former will take charge of that part of the work bearing on the food-habits of birds in relation to insects.

— The seeming anomaly is presented, by the excessive demand for furs, of the extermination of large species and the increase of smaller ones. This is obviously due to the fact that large animals require great space to roam over, while the smaller ones need but little territory, and propagate with rapidity, follow immigration and increase with the population in farm districts. Further, the increase of population diminishes the territory of large species, making them more accessible and increases the domain and support of the smaller animals. The annual extermination of the beaver is about 200,000 animals, of the muskrat about 2,150,000, and yet there is no perceptible diminution in their numbers. The grizzly and polar bears and Shetland seal are nearly exterminated. Of the last named only 200 skins were secured last year, and the price of cloaks made from them advanced to $1200.

— The American causeway, or basaltic columns, at Orange, New Jersey, is the largest yet exposed. The columns are compressed into a mass 750 feet long and 100 feet high, covering fourteen acres. The generality stand vertically, but some lie in a horizontal plane and others radiate from a common center. Interiorly they are a dark-blue color, covered with an incrustation of dust particles. They range in shape from prisms to octagons, the pentagons predominating. Underneath is an enormous deposit of red sandstone. The columns are being quarried for building blocks and micodons.

— Candidates for apprenticeships in the United States Navy must come within the following measurements:

Age.	*Weight.*	*Height.*	*Chest.*
14 to 15	70 lbs.	57 inches.	26 inches.
15 " 16	80 "	59 "	27 "
16 " 17	90 "	61 "	28 "
17 " 18	100 "	62 "	29 "

— Thos. Edwards, the Banff naturalist, so well known from Smiles' biography, is dead. Since the publication of Smiles' work he has enjoyed a pension of £50 per annum, and latterly he has been curator of Banff Museum.

— A dromedary in Central park, N. Y., gave birth, on May 17, to a calf weighing 105 pounds. This is said to be the third birth of the kind in the United States.

— The morning glory, natural grasses and other species of land life rapidly take the place of aquatic plants in the vast areas of drained lands in sub-tropical Florida.

— The Chicago Academy of Sciences has deposited its collection in commodious quarters at the Exposition building on the lake front.

——:o:——

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Biological Society of Washington, May 15. — Communication: Dr. C. Hart Merriam, habits of the short-tailed shrew (Blarina).

May 29.—Communications: Mr. John B. Smith, Ant's nests and their inhabitants; Dr. T. H. Bean, The trout of North America, with exhibition of specimens; Mr. L. O. Howard, On some new Chalcididæ; Mr. L. F. Ward, Exhibition of a specimen of the Palo la Cruz or Wood of the Cross.

New York Academy of Sciences, May 10.—A history of the society from its beginning to the present time, prepared by the secretary, was presented. It comprised the following sections: Origin; membership; biographical sketches of prominent members; changes of location; the old Lyceum building; collections; library; publications; change of name, etc., etc. Some of the old documents, books, etc., were exhibited.

May 17.—The following paper was presented: Ten years' progress in astronomy, Professor C. A. Young, of Princeton College.

May 24.—The subject of the sanitary influence of vegetation in cities and the importance of tree-planting to the health, beauty and summer temperature of New York, with practical suggestions in relation thereto, was presented by Dr. Stephen Smith and Professor D. S. Martin.

May 31.—On rock-crystal, its cutting in Japan, Germany and the United States, with exhibition of crystal spheres and other objects of transparent quartz, including some of the largest pieces in this country, by Mr. George F. Kunz.

Boston Society of Natural History, May 19.—Mr. F. W. Putnam showed a collection of implements and ornaments from Central America, and remarked on the evidence they present of an early migration from Asia to America; Dr. C. S. Minot discussed the origin of the mesoderm.

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PECULIARITIES IN THE MANUFACTURE OF JENSEN'S CRYSTAL PEPSIN:

NATURE OF THE IMITATIONS, ETC.

THE champion pepsin of the world! The only pepsin found worthy to be imitated! Even the wealthiest manufacturing chemists could not resist the temptation!

One party used glue as a cheapening adulterant for the production of scale pepsin; another party has now succeeded in flooding the market with their imitations of my scale pepsin, owing to its extreme cheapness. This party now declares (not to the profession) that they use sixty pounds of dry egg albumen, peptonized by two hundred hogs' stomachs. A third party wrap their imitations in an exact *fac simile* of my circular, making full use of my testimonials. The great injury these imitations cause my preparations can easily be understood.

The protection chiefly relied upon is through the profession's vigilance in discriminating between the genuine and the spurious article. When prescribing my pepsin, most physicians now underline my name thus, JENSEN'S Crystal Pepsin, and no misconception can excuse substitutions. The great reputation of this pepsin lies in that it is a peptone pepsin, *i. e.*, the texture of the stomachs in which the ferment is lodged is entirely dissolved, thereby obtaining all the pepsin. When thereto is added my recent improvement in precipitating from this solution all of the earthy and saline matter, leaving only the azotized constituent, containing all of the peptic principle, and finally, is further concentrated by drying it upon glass plates until brittle scales are formed, the reason for its high digestive power can easily be understood. Why it surpasses also in keeping qualities all of the former pepsins, is owing to its scaly and brittle texture, it being the only organic medicine in the materia medica produced for the market in scales.

It is also perfectly soluble upon the tongue, pleasant to the taste, and practically inodorous.

Although it commands a higher price than any other pepsin in the market, it is, nevertheless, the most prescribed. Its purity and solubility, combined with its great digestive power upon albuminoids, have inspired physicians of a suggestive mind to try it also as a solvent for diphtheritic membranes and coagulated blood in the bladder. The success also of these novel uses has already become generally known to the profession all over the world. Physicians writing for samples will receive prompt returns.

Dr. Hollman (*Nederl. Weekbl.*, 18, p. 272) reports the case of an old man, aged 80 years, suffering from retention of urine, in whom the introduction of a catheter failed to produce the desired result. It was found that the bladder contained coagulated albuminoid masses mixed with blood. A few hours after the injection of about 16 grains of Dr. Jensen's Pepsin dissolved in water, a large amount of a dark, viscid, fetid fluid readily escaped by the catheter.—*London Medical Record.*

Dr. Edwin Rosenthal, acting on the suggestion of Dr. L. Wolff, has used an acidulated concentrated solution of pepsin as an application to the membranes of diphtheritic patients, for which there seemed to be no other help than tracheotomy, and reports that it acted like a charm, dissolving the membranes, admitting a free aëration of the blood, and placing them soon on the road to convalescence. The solution he used was:

℞.	Jensen's Pepsin,	ʒ j.
	Acidi Hydrochloric, C. P.,	gtt. xx.
	Aquæ q. s. ft.,	fl. ℥ j.

M. S.—Apply copiously every hour with a throat-mop.—*From the Medical Bulletin.*

Formula for Wine of Pepsin:

℞.	Carl Jensen's Pepsin,	gr. 192.
	Sherry or Port Wine,	℥ viss.
	Glycerin puris,	℥ iss.
	Acid Tartaric,	gr. v.

Sig. f ʒ j. after meals. This is three grains of the pepsin in each teaspoonful.

For severe attacks of colic it has afforded present relief, after a few doses have been given in short intervals, when other remedies have failed.

CARL L. JENSEN,

HOME OFFICE, 2039 GREEN STREET,

PHILADELPHIA.

THE

AMERICAN NATURALIST.

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SOME DEITIES AND DEMONS OF THE NAVAJOS.

BY DR. W. MATTHEWS, U. S. ARMY.

THE great dry-paintings of the Navajo priests, which I described in a previous number of this journal (October, 1885), illustrate, as I then explained, the visions of the prophets. But the prophets saw the gods in their visions, hence the paintings contain pictures of the gods with all their hieratic belongings. The characters which perform in the great dances conducted by the priests, are representatives of the gods. In the ancient creation-myth of the tribe some descriptions of the gods are incidentally given. In the later myths, recounting the acts of the prophets, more exact descriptions are to be found. It is from such material as this—these oral traditions, these paintings, these ceremonies, with their hundreds of songs and elaborate unchangeable rituals, handed down from generation to generation by word of mouth and by example only—that the student must evolve the nature and scope of their worship.

In one of the great ceremonies, that of the *Kledji Hathal*, or *Gaybechy*, there are, according to the circumstances, from twelve to sixteen different supernatural characters represented. Some of these, like the *gaybaäd*, being a numerous race of divine ones, are represented by many dancers—men masked, dressed and painted to represent gods, bearing sacred wands and talismans and symbolizing in every act and motion something in the lives of their prototypes; living and breathing idols to whom the suppliant prays and offers his sacrifices, well knowing that he addresses with reverent prayers only his own brother or uncle masquerading in the panoply of divinity.

seemed to be the principal source of the glaciers which became confluent to form the great ice-sheet. In its advance this ice-sheet probably met and amalgamated with a number of already existing local glacial systems, and it was suggested that there was no necessity for assuming either an extraordinary thickness of ice at the pole or great and unequal elevations and depressions of land.

Detailed studies made by the author in Ireland, in 1885, had shown remarkably similar glacial phenomena.

The large ice-sheet which covered the greater part of Ireland was composed of confluent glaciers, while distinct and local glacial systems occurred in the non-glaciated area. The principal ice-sheet resembled that of America in having for its center a great inland depression surrounded by a rim of mountains.

These appear to have given rise to the first glaciers, which after uniting poured outwards in all directions. Great lobes from this ice-sheet flowed westward out of the Shannon and out of Galway, Clew, Sligo and Donegal bays, northward out of Loughs Swilly and Foyle, and south-eastward out of Dundalk and Dublin bays, while to the south the ice-sheet abutted against the Mullaghareirk, Galty and Wicklow mountains or died out in the plains.

Whether it stopped among the mountains or in the lowlands its edge was approximately outlined by unusual accumulations of drift and boulders, representing the terminal moraines. As in America, this outer moraine was least distinct in the lowlands, and was often bordered by an outer fringe of drift several miles in width.

South of an east and west line extending from Tralee to Wexword is a non-glaciated zone free from drift. Several local systems of glaciers occur in the south of Ireland, of which by far the most important is that radiating from the Killarney mountains, covering an area of 2000 square miles, and entitled to be called a local ice-sheet. Great glaciers from this Killarney ice-sheet flowed out of the fiord-like parallel bays which indent the south-western coast of Ireland. At the same time the Dingle mountains, the Knockmeal down and Comeragh mountains, and those of Wexford and Wicklow, furnished small separate glaciers, each sharply defined by its own moraine.

No evidence of any great marine submergence was discovered, although the author had explored the greater part of Ireland, and the eskers were held to be phenomena due to the melting of the ice and the circulation of subglacial waters. The Irish ice-sheet seemed to have been joined at its north-eastern corner by ice coming from Scotland across the North channel. All the evidence collected indicates that a mass of Scotch ice, reinforced by that of Ireland and England, filled the Irish sea, overriding the Isle of Man and Anglesey, and extending at least as far south as Bray Head, south of Dublin. A map of the glaciation of Ireland was exhibited in which the observations of the Irish geologists and of the author were combined, in which was shown the central sheet, the five local glacial systems, all the known striæ, and the probable lines of movement as indicated by moraines, striæ and the transport of erratics.

The glaciation of Wales was then considered. Wales was shown to have supported three distinct and disconnected local systems of glaciers, while at the same time its extreme northern border was touched by the great ice-lobe of the Irish sea. The most extensive local glaciers were those radiating from the Snowden and Arenig region, while another set of glaciers radiated from the Plinlimmon district and the mountains of Cardiganshire, and a third system originated among the Brenockshire beacons. The glaciers from each of these centers transported purely local boulders and formed well-defined terminal moraines. The northern ice-lobe, bearing granite boulders from Scotland and shells and flints from the bed of the Irish sea, invaded the northern coast but did not mingle with the Welsh glaciers. It smothered Anglesey and part of Carnarvonshire on the one side, and part of Flintshire on the other, and heaped up a terminal moraine on the outer flanks of the North Welsh mountains. This great moraine, filled with far-traveled northern erratics, is heaped up in hummocks and irregular ridges, and is in many places as characteristically developed as anywhere in America. It has none of the characters of a sea-beach, although often containing broken shells brought from the Irish sea. It may be followed from the extreme end of the Lleyn peninsula (where it is full of Scotch granite erratics) in a north-easterly direction through Carnarvonshire past Moel Tryfan and along the foot of the mountains east of Menai strait to Bangor, where it goes out to sea, reappearing further east at Conway and Colwyn. It turns south-eastward at Denbigshire, going past St. Asaph and Halkin mountain. In Flintshire it turns southward and is magnificently developed on the eastern side of the mountains, at an elevation of over 1000 feet between Minera and Llangollen, south-west of which place it enters England. There is evidence that where the ice-sheet abutted against Wales it was about 1350 feet in thickness. This is analogous to the thickness of the ice-sheet in Pennsylvania, where the author had previously shown that it was about 1000 feet in thickness at its extreme edge and 2000 feet thick at points some eight miles back from its edge. The transport of erratics coincides with the direction of striæ in Wales as elsewhere, and is at right angles to the terminal moraines.

The complicated phenomena of the glaciation of England, the subject of a voluminous literature and discordant views, had been of high interest to the author, and had led him to redouble his efforts toward its solution. He had found that it was possible to accurately map the glaciated areas, to separate the deposits made by land ice from those due to icebergs or to torrential rivers, and to trace out a series of terminal moraines, both at the edge of the ice-sheet and at the edge of its confluent lobes. Perhaps the finest exhibition of a terminal moraine in England is in the vicinity of Ellesmere, in Shropshire. A great mass of drift several miles in width and full of erratics from Scotland and from Wales, is here heaped into conical hills which enclose "kettle holes" and lakes, and have all the characters of the "kettle moraines" of Wisconsin, Like the latter, the Ellesmere moraine here divides two great lobes of ice, one coming from Scotland the other from Wales. This moraine may be traced continuously from Ellesmere eastward through Hadeley, Macclesfield, to and along the western flank of the Pennine chain, marking throughout the southern edge of the ice-sheet of Northern England. From Macclesfield the same moraine was traced northward past Stockport and Staley bridge to Burnley and thence to Skipton in Yorkshire. Northeast of Burnley it is banked against the Boulsworth hills up to a height of 1300 feet in the form of mounds and hummocks. South and east of this long moraine no signs of glaciation were discovered, while north and west of it there is every evidence of a continuous ice-sheet covering land and sea alike. The striæ and the transport of boulders agree in proving a southerly and south-easterly direction of ice-movement in Lancashire and Cheshire.

From Skipton northward the phenomena are more complicated. A tongue of ice surmounted the watershed near Skipton and protruded down the valley of the Aire as far as Bingley, where its terminal moraine is thrown across the valley like a great dam, reminding one of similar moraine dams in several Pennsylvania valleys. A continuous moraine was traced around this Aire glacier. Another great glacier, much larger than this, descended Wensleydale and reached the plain of York. The most complex glacial movements in England occurred in the mountain region about the Nine Standards, where local glaciers met and were overpowered by the greater ice-sheet coming down from Cumberland. The ice-sheet itself was here divided, one portion going southward, the other, in company with local glaciers and laden with the well-known boulders of the "Shap granite," being forced eastward across Stainmoor forest into Durham and Yorkshire, finally reaching the North sea at the mouth of the Tees. The terminal moraine runs eastward through Kirby Ravensworth toward Whitby, keeping north of the Cleveland hills, and all Eastern England and south of Whitby appears to be non-glaciated. On the other hand all England north of Stainmoor forest and the river Tees, except the very highest points, was smothered in a sea of solid ice.

There is abundant evidence to prove that the ice-lobe filling the Irish sea was thicker towards its axis than at its edges, and at the north than at its southern terminus, and that it was reinforced by smaller tributary ice-streams from both England and Ireland. It may be compared with the glacier of the Hudson River valley in New York, each having a maximum thickness of something more than 3000 feet. The erosive power of the ice-sheet was found to be extremely slight at its edge but more powerful farther north, where its action was continued for a longer period. Towards its edge its function was to fill up inequalities rather than to level them down. It was held that most glacial lakes are due to an irregular dumping of drift rather than to any scooping action. Observations in England and Switzerland coinciding with those in America to confirm this conclusion. Numerous facts on both sides of the Atlantic indicate that the upper portion of the ice-sheet may move in a different direction from its lower portion. It was also shown that a glacier in its advance had the power of raising stones from the bottom to the top of the ice, a fact due to the retardation by friction of its lower layers. The author had observed the gradual upward passage of sand and stones in the Grindenwald glacier, and applied the same explanation to the broken shells and flint raised from the bed of the Irish sea to the top of Moel Tryfan, to Macclesfield and to Dublin mountains.

The occurrence of stratified deposits in connection with undoubted moraines was shown to be a common phenomenon, and instances of stratified moraines in Switzerland, Italy, America and Wales were given. The stratification is due to waters derived from the melting ice, and is not proof of submergence.

It was held that, notwithstanding a general opinion to the contrary, there is no evidence in Great Britain of any marine submergence greater than about 450 feet. It was expected that an ice-sheet advancing across a sea should deposit shell fragments in its terminal moraine.

The broad principle was enunciated that wherever in Great Britain marine shells occur in glacial deposits at high levels, it can be proved both by striæ and the transport of erratics that the ice advanced on to the land from out of the sea. The shells on Three Rock mountain, near Dublin, and in North Wales and Macclesfield, all from the Irish sea, the shells in Cumberland transported from Solway Firth, those on the coast of Northumberland brought out of the North sea, those at Airdree, in Scotland, carried eastward from the bottom of the Clyde, and those in Caithness from Moray firth, were among examples adduced in proof of this principle. The improbability of a great submergence not leaving corresponding deposits in other parts of England was dwelt upon.

It was also held that there was insufficient evidence of more than one advance in the ice-sheet, although halts occurred in its retreat. The idea of successive elevations and submergence with advances and retreats of the ice was disputed, and the author held that much of the supposed interglacial drift was due to subglacial water from the melting ice.

The last portion of the paper discussed the distribution of boulders, gravels and clays south of the glacial area. Much the greater part of England was believed to have been uncovered by land ice. The drift deposits in this area were shown to be the result in part of marine currents bearing icebergs during a submergence of some 450 feet. The supposed glacial drift about Birmingham and the concentration of boulders at Wolverhampton were regarded as due to the former agent, while the deposits at Cromer and the distribution of Lincolnshire chalk across Southern England was due to the latter. The supposed esker at Hunstanton was held to be simply a sea-beach, and the London drift deposits to be of aqueous origin. Thus the rival theories of floating icebergs and of land glaciers were both true, the one for Middle and Southern England, the other for Scotland, Wales and the north of England; and the line of demarkation was fixed by great terminal moraines.

The paper closed with an acknowledgment of indebtedness to the many geologists of England and Ireland who had uniformly rendered most generous assistance during the above investigation.

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SOME PECULIARITIES OF THE LOCAL DRIFT OF THE ROCKY MOUNTAINS.[1]

BY DR. THEO. B. COMSTOCK.

ALL authorities upon the subject of the glacial deposits of the Rocky Mountain region agree in describing them as local or much restricted in extent. Some writers dismiss the matter with this remark, leaving it to be inferred that in other respects the character of the drift is quite similar to the well-known débris of the Eastern United States. Others have been more explicit and have shown how special conditions of topography have affected the accumulations in certain localities. In all cases where the details have been given the evidence is strong of excessive erosion, but almost invariably the transportative effects have been remarkably slight. As a natural result we meet with much variety in the gulches and gorges which can be traced to such an origin, while the diluvium of the subsequent melting period is made up of homogeneous materials in each instance, but wholly of local detritus. This gives to many of the unmodified morainal deposits a resemblance to alluvium which is quite striking. On the other hand, in some places (as notably near the head of Wind river, Wyoming) iceberg deposits are well simulated by the collections of boulders which have evidently rolled down the steep

[1] Paper read before the A. A. A. S., Section E, Buffalo, 1886.

slopes left in side-gulches by the retrêat of the diminutive glaciers. Existing glaciers in the Wind River mountains and in the San Juan mountains (S. W. Colorado), enable us to witness the actual production of some of these peculiar effects and to understand more clearly how *defragation*[1] has played a very important part in the rough chiseling of mountain features in the far West.

The general southward trend of the glacier-cut cañons is very marked, although numerous side-gulches follow more or less transverse courses. In Northern Wyoming, at the close of the Glacial Period, the old Tertiary lake basins were still in condition to receive and assort the material deposited by the melting ice, and the greater part of the drainage was easy; but in some cases in the interior of the mountain masses to the northward, narrow, elongated basins were ploughed out below the general drainage, although very few of these now exist in which an outlet has not since been made. In the heart of the Wind River mountains a remarkable structure of this kind is to be seen nearly opposite old Camp Brown, at the head of the North fork of the Popo-agie river, near the base of Fremont's peak. Here two of these deep, narrow cañons run parallelwise for several miles, with small glaciers still acting upon their shaded sides, the drainage from one being to the Missouri tributaries, the other feeding affluents of the Colorado drainage. In Southern Colorado somewhat similar features are apparent, but the excessive folding and faulting of the strata have very much complicated matters, so that the results are rather unique. The same type, modified by lithological and structural conditions, may be observed in the Gunnison region and about the sources of the Snake and Yellowstone rivers in Wyoming, but the special San Juan features are not repeated exactly in any other district so far as my observation goes. The distinctive peculiarity lies in the duplex character of the erosion; that is to say, there are two zones of glaciation vertically, the upper largely representing the transportative action, the lower being eroded without removal of the débris to any great extent. The imperfect drainage had fastened the ice-sheet so that it could move as a unit only in the superficial portion, while the lower part acted like a slowly work-

[1] I propose this term to express the breaking or tearing down of masses of rock from the walls of gorges, as distinguished from the ordinary abrading or grinding action of the glacier.

ing plough, which cut deeply but not so extensively as the overriding mass. In the more elevated tracts, therefore, the lower portion often lay in grooves like *culs-de-sac*, and many of these exist to-day, connected with the main channels often by reversed or indirect drainage. The *lower limit of exportation*, which defines the line of junction of the two layers, follows nearly the contour of 11,000 feet above sea-level (varying from 10,500 feet to 11,500 feet). The side-gulches, except where eroded by more recent aqueous action, commonly join the main cañons on this grade. The "timber-line" is fairly continuous with these *debouchures*, and I am satisfied that this feature has been largely instrumental in determining that sharp line of demarkation. Undoubtedly the melting of the ice in the cañons left many side-glaciers discharging by "ice-falls" over the walls for a long time afterwards, the vegetation growing up to this limit, because the land-locked cañons were for a period filled with water which arranged more or less of soil along the sides of the channels. This fact is clearly proven by the occurrence of terraces, in such lacustrine material, up to a height of 1000 feet above the present stream beds in places. The positions of scattered boulders in the cañons, and of those imbedded in the deposits along the walls afford further evidence of the local transportation of material by floating masses of ice, which dropped their burdens upon melting.

The drift of the Rocky mountains thus possesses peculiar interest, corroborating the notion of its intimate relation to the glacial deposits of the east, and yet exhibiting a variety in detail which may aid materially in unraveling obscure points in the history of other areas with weak development of the same conditions. The local character of the effects has prevented many from appreciating the really gigantic erosion and deposition which have taken place.

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THE MAMMARY GLAND OF THE ELEPHANT.

BY SPENCER TROTTER, M.D.

IN studying any particular animal form we are wont to refer to some other well-known type as a basis for comparison, and in this way gain an idea of the animal's place in life, its relations to the environment and to the other beings among which it lives. As our studies extend and we become more widely acquainted with the many diverse forms, we quickly note any departure on the part of an organ from its usual form or position, and are thus led directly to enquire into the cause or causes which brought about the change. In those mammals whose habit it is to suckle their young standing, namely, the Ungulata, any one who has given the least thought to the subject is aware that their mammary glands are situated at the posterior part of the ventral line, *i. e.*, in the inguinal region, or groin. A striking exception to this is seen in the elephant, where these glands are located anteriorly, in the pectoro-axillary spaces.

The elephant holds a unique position in nature, representing the last of a long ancestral line which attained its maximum development in the Tertiary. Its immediate progenitor most likely occupied the southern range, thus escaping extinction in the drift and glacial epochs, and carrying down to present times this highly interesting and peculiar form. With no relatives extant, the elephant forms a separate and distinct order, the Proboscidia, but curiously enough possessing characters which ally it with the widely different Rodentia; it is herbivorous, and in general habit and mode of life is an ungulate, in a portion of which order it was usually assigned a place in the older nomenclature.

It is as an ungulate or "hoofed animal," therefore, that the elephant interests us, and from the fact that like all the species of that order the female is in the habit of suckling her young in the standing posture we are led to ask ourselves the reason for the striking exception in the position of the mammary glands. It will be understood that I refer to animals which give birth as a rule to one, or at most two offspring at a time, and which consequently have the minimum number of glands, not to those which "litter" like the hog family and present a series of glands running along each side of the belly line.

In dealing with a subject of this nature we enter one of those broad fields of philosophic science whose farther boundary, if indeed it have any, lies far below our mental horizon. The rock-imbedded bone of the palæontologist, which elsewhere bears such useful testimony, is comparatively of little value, and even the profounder facts of embryology fail to tell us why such striking differences occur, and what brought them about. It is a subject involving the underlying principles of tissue metamorphosis and nutrition in their broadest sense; a study vague enough in the present, but rendered far more so by the lapse of time. Action and reaction between organism and environment; the demands of increasing functional activity upon plastic tissue, and the effects of *use* and *disuse*, these are the fundamental principles involved, and we can only surmise at the primitive condition of affairs from the few tangible points presented to us. By attention to the following facts we may be able to gain a few ideas which will possibly throw some light upon the subject. At the anterior end of the great arterial trunk (*aorta*) two branches arise (*subclavian*) which proceed to the fore limbs. These, in turn, give off each a branch (*internal mammary*) which passes downward and backward along the anterior thoracic wall. At the posterior end of this great trunk two other branches arise (*iliac*), proceeding to the hind limbs, these also giving off each an artery (*superficial epigastric*) which runs forward in the abdominal wall to anastomose with the terminal branches of the internal mammary, thus forming an arc on each side of the ventral median line from neck to groin. This we will call the *mammary arc*. Now it is evident that in those mammals whose glands are situated solely in the pectoral region, as in Primates, Chiroptera, elephant, etc., the internal mammary artery is the main supply of the gland; while in those in which the structure is inguinal, as in the horse, deer, etc., the superficial epigastric is the main blood feeder.

Again, when the glands are situated in a row along the under surface of the body, as in Carnivora, Suidæ, etc., the entire *arc* of blood-vessels comes into play as a source of supply. We have every reason to believe that this latter state of affairs was the original arrangement of the parts, as the lowest and most ancient forms now extant present this same condition correlated with plurality of young at a birth, which is also undoubtedly a primitive condition. As specialization proceeded a reduction in the number of young at a birth followed, and consequently fewer glands were used; those only which were the most convenient to the young animal, while the rest atrophied and finally disappeared from want of use. Whether the prototype of the Proboscidians was large or small, whether it produced a number of young at a single birth, and consequently possessed a series of glands running along the belly, or what its habits were we cannot say; but the possibility of such a condition having existed can no more be denied than it can be proved, and we have good reasons in believing such to have been the case. We know the rodents to be a very ancient group, and if the ancestor of the Proboscidian was allied to them in any way it, in all probability, presented many points of affinity in structure and habits.

If we take the foregoing in a hypothetical sense, supposing the ancestral form to have given birth to a number of young at one time, and to have possessed a corresponding number of glands, we have yet to answer the question: Why should the elephant, after specialization and reduction, present pectoral instead of inguinal glands?

The hog family, Suidæ, while not a primitive form of ungulate, still retain many ancestral characters, among them plurality of young and gland structure, and we have every reason to believe that the entire order sprang from a similarly low form; yet they all, after specialization and reduction, present inguinal glands.

There may have been many causes which will never occur to us why the young Proboscidian should use the anterior pair of glands; but two of them have occurred to me as a feasible, if not in our present state of knowledge, a satisfactory explanation.

Any one whose eye is accustomed to take in the animal form will have noticed that in the majority of hoofed animals the belly line slopes upward and backward; take the horse, deer, ox, camel, or any of the large herbivores for example. Now the reverse is true of the elephant, the belly line sloping downward and backward, this being in part due to the large pendulous genitals in the female, and in part to the tremendous abdominal viscera bagging down and occupying a rather short space lengthwise in proportion to the animal's general build. The young elephant, sucking as it does with its mouth, and possessing a short and comparatively immobile neck, would find it very inconvenient if the glands were situated in the inguinal region with the massive knees of the mother in the way; and this difficulty would be still more increased as the young animal grew. As it is, the nipple projects horizontally from the pectoral region, the most convenient point, with nothing to interfere; and as the early prototype became more and more specialized, the fewer, and finally the single offspring resulting used this most convenient gland to the exclusion of the others, which have disappeared from want of use in the long lapse of time before the Proboscidian became such.

Very different is the case with the arched, cleanly-cut inguinal space of the female ungulate, and its long, flexible-necked offspring, where the mammary gland is carried so easily by the mother, and is so accessible to the young. Here the anterior glands are the ones that have been discarded.

These are mere speculations, for what can we do with such a subject? Surely not discard it altogether! Far better attempt even in the roughest way to interpret with what little light we have from the past, and fall wide the mark in our conclusions, than to pass unnoticed one fragment in the great history of life.

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IS LITTORINA LITOREA INTRODUCED OR INDIGENOUS?

BY W. F. GANONG.

It is now nearly thirty years since *Littorina litorea* (Linn.), the English periwinkle, was first reported from American waters, but the question as to whether it has been recently introduced or was an original inhabitant of our shores is still unsettled. This mollusk, though not known by naturalists to occur upon the coast of Acadia and New England previous to its discovery at Halifax in 1857 by John Willis, is at present very abundant from the Gulf of St. Lawrence to Connecticut.

Professor Verrill (Amer. Jour. Sci., iii, IV, p. 133, 1874) says of it: "It has been supposed by several writers that this shell (*L. litorea*) has been recently and accidentally introduced from Europe; but Dr. Dawson informs me that he collected it more than thirty years ago in the Gulf of St. Lawrence. It is abundant at Halifax, and we have other specimens from Kennebunkport, Me., Hampton Beach, N. H., and Provincetown, Mass. There is really no sufficient evidence that it was not an inhabitant of our shores before the advent of Europeans, but local in its habitats. It may have become more diffused in recent times by commerce, or it may have been overlooked formerly by collectors."

The causes determining the geographical distribution of animal and plant life are a subject of the greatest importance to naturalists, and any contribution to it has its value. So peculiar and interesting are the known facts in regard to the distribution and spread in America of the shell we are considering, that an inquiry into the nature of these facts, and a search for an explanation for them becomes a matter of more than special importance. The value of the settlement of the question as to whether *Littorina litorea* has been introduced in recent times or is a native of America, is not limited to the settlement of this fact only. It has a broader value as well, inasmuch as it has a bearing upon the science of the distribution of animals.

It must be remembered that no species of animal or plant can, in the strict sense of the word, be indigenous to both Europe and America. If such were the case it would be necessary to suppose that the two independent lines of descent, either from a common near or remote ancestor, culminating in the species, had followed precisely identical courses of development. The latter would require precisely identical conditions of environment—and such we know would not exist upon two separate continents. Hence a shell which is common to two continents must in some way have been introduced from one to another. It may be introduced by the agency of man, or by purely natural and physical causes, such as ocean currents, etc. For want of a better term the word *indigenous* has been used in the present paper to apply to a species introduced in past time by *natural* agencies and now thoroughly established as a resident.

Such a species is our so-called "native periwinkle," *Littorina palliata* (Say). It is common to Europe, Greenland and America, and has existed for a long time in all three countries, being found fossil in the Post-pliocene of all of them. It will be presently shown that this shell was probably introduced from the continent in which it *originated* to the other by way of Greenland and Iceland, and by strictly natural agencies. We therefore speak of it as indigenous to America, though whether its descent from its parent species took place here or in Europe we are unable to say. But we hope to be able to show that *Littorina litorea* did not exist in America until introduced from Europe by man, and that since the beginning of the present century.

Mr. John Willis, who was the first to announce its discovery in America (Trans. Nova Scotia Inst. Nat. Sci., Vol. 1), found it at Halifax in 1857. He considered it to be indigenous to Nova Scotia chiefly for the reason that "some of the oldest inhabitants have assured me that they have 'often picked the periwinkle, the same as the English one,' on the shores contiguous to Halifax when they were only school-boys."

The only other evidence that has been found to show that the shell was known in Nova Scotia, previous to 1857, comes in a private letter to the writer from Mr. E. Gilpin, of Halifax. He says: "Historical evidence in the shape of old English settlers shows it to have been known in the province as far back as 1800."

How much reliance can be placed upon the unscientific evidence of old settlers is a question; but granting that they did not confound it with the native form, and that they actually saw it previous to 1857, nothing more is proved than that the shell existed in Nova Scotia some years before Willis found it. Similarly it may be said of the fact that Dr. Dawson "collected it more than thirty years ago in the Gulf of St. Lawrence," that it proves (if granted) only that the shell was to be found there earlier than any published record shows. Or it may be that, if introduced, it was introduced at more than one point.

It is somewhat remarkable, however, that, as will be shown farther on, no other collector found this conspicuous shell in the gulf until after 1870, although Dr. Dawson must have found it at least as early as 1844. We know that it increases with great rapidity wherever introduced. Why then, if it existed there, did it not increase sufficiently to enable some other collector to find it? None of the lists of Bell, Whiteaves or Dr. Dawson himself mention it until after 1870. It is to be regretted that we have not some record of Dr. Dawson's discovery of the shell so far back, besides the note by Professor Verrill who doubtless writes from memory.

If this shell be indigenous to our shores, it must have been confined, previous to say 1850, exclusively to the Nova Scotia coast. That this must be so is shown as well by other facts as by the many lists we have of New England and Gulf of St. Lawrence shells, all of which mention the native periwinkles, *L. palliata*, *L. rudis*,[1] *L. tenebrosa*,[1] while *L. litorea* never appears. That the latter could have been present but "overlooked by collectors" is altogether out of the question. It is a much larger and more conspicuous shell than the native forms, has the same habitats, and wherever it occurs at all occurs abundantly.

[1] For convenience we will consider these two to be distinct species, although they are probably varieties of the same species.

Among the many lists of New England shells which might be named, the following have been selected:

Gould's "Invertebrata of Mass.," 1st ed. (1841), mentions *L. palliata*, *rudis* and *tenebrosa* but not *litorea*.

Mighel's list of the shells of Maine[1] (1843) mentions *L. palliata*, *rudis* and *tenebrosa* as occurring "in the greatest profusion," but *L. litorea* is not in the list.

Reed's "Catalogue of the Shells of Mass."[2] (1845) mentions the same three but not *litorea*.

Russell's "Retrospect of some of the Shells found in Essex county, Mass."[3] (1851), mentions the same three but not *litorea*.

Tuft's "List of Shells collected at Swampscott Lynn and vicinity" (1853) mentions the same three as abundant, but not *litorea*.

Stimpson's "List of the marine Invertebrates of Grand Manan" (1854) mentions *L. palliata* (= *L. littoralis*) and *L. rudis*, but not *L. litorea*.

Tuft's "Catalogue of Shells in the State cabinet [of Mass.]" (1859) mentions the same three but not *litorea*.

Nor has it been reported until quite recently from the Gulf of St. Lawrence.

Dr. Dawson's "A week in Gaspé"[4] (1858) mentions *L. rudis* and *L. palliata*, but not *L. litorea*. If Dr. Dawson found it in the Gulf of Lawrence "thirty years ago," it must have been at some other point.

Robert Bell's "List of the Mollusca of Eastern Canada"[5] (1859) mentions *L. palliata* only.

J. F. Whiteaves' "On the marine Mollusca of Eastern Canada"[6] (1869) mentions *L. palliata* (*littoralis*), *L. rudis* and *L. tenebrosa*, but not *L. litorea*.

Although the evidence of these lists is only negative, their combined force is so strong (even had we no other evidence) that they practically prove that the shell did not exist upon the New England coast, and probably not in the Gulf of St. Lawrence, previous to the middle of the present century. Since 1857 its spread has been phenomenally rapid. A paper, by A. F. Gray, in Science News for 1879, gives many localities which it had come to inhabit upon the New England coast, and the known facts of its spread are thus summarized by Professor Verrill:[7]

"It is well known to American conchologists that this common European species has become well established upon the New England coast within ten or twelve years, appearing first upon

[1] Boston Jour. Nat. Hist., IV.

[2] See for this as well as other lists, Binney's "Bibliography of American Conchology," Smithsonian, Vol. I.

[3] Jour. Essex county Nat. Hist. Soc., I.

[4] Can. Nat., III, 321.

[5] Can. Nat., IV, 197.

[6] Can. Nat., ii, IV, 48. See also Can. Nat., ii, IV, 270.

[7] Am. Jour. Sci., iii, XX, 251.

the coast of Maine about 1868; Dr. Dawson, however, states that he collected it on the shores of Nova Scotia at a much earlier date. I wish at present merely to put on record some additional data as to its recent progress along the coast. In 1873 it was collected in abundance at Saco, Maine, by the U. S. Fish Commission, and was found sparingly at Peake's island, Casco bay. In 1872 it was very rare at Provincetown, Mass., but in 1875 it was common there. In 1875 it was collected by the writer at Barnstable, Mass., on the shores of Cape Cod bay, in large quantities. In 1879 it had become exceedingly abundant at Provincetown. In 1875 our parties found two specimens only on the southern shores of Cape Cod, at Wood's Holl, but in 1876 it was found to be common there, and is now very abundant. The first specimen found so far westward as New Haven was obtained by Professor S. I. Smith during the past winter ['79–80]. Other solitary specimens have since been obtained here by E. A. Andrews and by J. H. Emerton. It is at present exceedingly abundant at Newport, R. I."

It is spreading into the Gulf of St. Lawrence, too, finding probably a congenial habitat in the warmer water of Northumberland straits, which contain so many southern forms. J. F. Whiteaves found it at Souris and Charlottetown, P. E. I., in 1873.[1]

Do not these facts afford an exceedingly strong argument that the shell has been introduced? Its rapid increase southward shows that a favorable habitat was there waiting for it—a much more favorable one than the Nova Scotia coast. The conditions which determine its spread were here at work a century ago, but it was not found anywhere in New England.

As has already been pointed out, no species of animal or plant can be truly indigenous to the two continents. It must either have originated in one and spread to the other, or it must have originated at some other point and spread to both. A shell such as we are considering, which is at present common to both continents must either have been introduced from one to the other by man's agency, or by purely natural means. If it can be shown that the natural means did not operate in this case, it would prove that man must have introduced it; and the stronger the probability of the former, the stronger will be that of the latter.

Winds or the agency of birds, so active in the distribution of plants, could hardly operate upon a shell or its young. Ocean currents seem to be the only method of conveyance. But by no means could either *L. litorea* or *L. palliata* directly cross the At-

[1] Report on deep-sea dredging operations in the Gulf of St. Lawrence.

lantic in such a way—they must have come, if they came by natural means at all, by way of Iceland, Greenland and Labrador.

This we find actually was the case with *L. palliata*. Where it originated the writer does not know, nor does it matter in the present connection, but certain it is that it is now common to England,[1] Greenland,[2] Labrador,[3] Acadia and New England. And not only does it exist in these places now, but it has for a long time past, for it is found fossil in Post-pliocene deposits in England, in Southern Greenland[3] (*L. grönlandica* = *L. palliata*) and in Canada, though not actually in Acadia. Dawson reports it from the Post-pliocene of Gaspé,[4] and Lyell from Beauport.[5] We may hence conclude that *L. palliata* is, in the sense in which we have used the word, indigenous to America.

But as to *L. litorea*, not only does the latest and best list of Greenland shells[2] make no mention of its occurrence there, nor does Packard in a list of the shells of Labrador[3] (though he mentions *L. palliata* and *L. rudis* as "abundant" and "not uncommon"), but no trace of it has as yet been reported from any Post-pliocene deposits of Greenland, Labrador, Canada or New England. It is a shell much more likely to be preserved in such deposits than *L. palliata*, being much larger and stouter—though neither, from their rock-loving nature, stand as much chance of being preserved as sand or mud-inhabiting species. All of these facts tend to show that *L. litorea* was not introduced from one continent to the other either at the same time or by the same means as *L. palliata*, and that if by any unknown agency whatsoever *L. litorea* had reached America, it must have been confined to Nova Scotia alone until the middle of the present century.

But we have another source of information about the shells which lived upon our coast before the advent of the Europeans. In the Indian shell-heaps along the coast of Maine and New Brunswick, most of the edible mollusks of the coast are found among the heaps of clam-shells. Dr. Wyman reports[6] that in a shell-heap at Crouch's cove, Casco bay, Maine, *Littorina palliata*

[1] Forbes and Hanley's British Mollusca, Vol. III.

[2] Manual and instructions for the Arctic expedition. London, 1876.

[3] Packard, Mem. Bost. Nat. Hist. Soc., Vol. I.

[4] Can. Nat., II, 408.

[5] Can. Nat., I, 345.

[6] AM. NAT., Vol. I, No. II, 1868.

was found along with such species as *Purpura lapillus*, *Natica heros*, *Buccinum undatum*, *Nassa obsoleta*, *Nassa trivittata*, etc., but he makes no mention of *L. litorea*. Mr. G. F. Matthew, in his account[1] of investigations into an undisturbed shell-heap on the shore of Passamaquoddy bay, New Brunswick, after mentioning the occurrence of several littoral species, says: "The rock periwinkle (*Littorina rudis*) is occasionally found * * * but the common European periwinkle (*Littorina litorea*), now so common on this coast, is entirely wanting." In a private letter to the writer the same gentleman says: "I have seen no trace of *L. litorea* in any shell-heap." That the Indians would have collected the smaller native periwinkle and other small littoral species, and not the larger English one, were the latter present, is inconceivable, no matter whether the former had been collected for food or only accidentally introduced into the shell-heaps. The same causes should have introduced *L. litorea* if it had existed at these places. Again the conclusion is forced upon us that if the shell existed in America at the time of the formation of the shell-heaps, it must have been confined to Nova Scotia. We have no published lists of shells from the Nova Scotia shell-heaps, nor has the writer been able to find by private inquiry any satisfactory account of them.

All of the facts that we have so far mentioned in connection with this shell show that if it existed at all in America previous to the present century, it must have been confined to the coast of Nova Scotia. There are other general considerations which show that in all probability it did not exist there. One of these we have already mentioned—the fact that it was not introduced in the same way as *L. palliata*, by way of Greenland, and therefore was probably not naturally introduced into America at all.

Many undoubtedly European species of both animals and plant could be named which, upon their artificial or accidental introduction into this country, have driven out and well-nigh exterminated closely-allied native species. Everywhere upon the coast of Nova Scotia as well as that of the rest of Acadia and New England, *L. litorea* is doing precisely this, driving out the native *L. palliata*. Everywhere the native form gives way before it and becomes rare, just in proportion as the English form becomes abundant. This fact of itself gives us strong *a priori* grounds

[1] Bull. N. B. Nat. Hist. Soc., III, 1884.

for believing the shell to have been recently and accidentally introduced, but it acquires additional force taken in connection with other facts which point to the same conclusion.

But granting for a moment that the shell did exist in Nova Scotia previous to this century—where it must have been confined if it was in America at all—what an anomalous condition of life we have. At present, as we follow its progress southward, we find it growing more and more abundant. The writer has very frequently noticed its distribution on the Southern New Brunswick coast, but it there occurs in nothing like the profusion in which he has seen it at Nahant, Mass., or Newport, R. I. In these two places, and they are like other localities in these two States in this respect, it literally covers the rocks, the native species becoming comparatively rare. What is the meaning of the fact that it becomes more abundant southward? Can it mean anything else than that (within certain limits) as it goes south it meets with a more and more congenial habitat? If this be so, and we can see no other conclusion, it shows that *L. litorea* thrives better in warmer water than that of the coasts of Nova Scotia and New Brunswick, and therefore that the natural home of the species, or the place where it originated was in warmer water than that of Acadia. This conclusion is strengthened by the fact of its non-occurrence in Greenland or Labrador, to both of which places it should have been carried by the same agencies which took *L. palliata* there. The latter is certainly a more northern species than the former, and it may be that the conditions of life in these two places are altogether unsuited to the more southern *L. litorea*, in which case it could certainly not have been carried from one continent the other by way of Greenland. *If* then *L. litorea* existed upon the Nova Scotia coast as (in the sense in which we are using the word) an indigenous species, it was existing without spreading under comparatively unfavorable conditions of temperature, etc., while favorable conditions were waiting for it not far to the southward. Surely the agencies which took it from one continent to the other (if naturally introduced) could have carried it to the New England coast. Is it not more natural to suppose, what so many of the facts indicate, that the warmer waters in which it thrives the best are like those of its home, and that its home is in the waters of the English coast, which we know to be so much warmer than those of Nova Scotia?

But again, what is the meaning of its wonderfully rapid spread, and why, if it existed in Nova Scotia previous to say 1850, did it not begin to spread before? Its spreading as rapidly as it has, shows that it was only waiting for the opportunity to take advantage of it, but why, if it is indigenous, did it not begin to spread sooner? Surely the same causes which have carried it south since 1850 were in operation before. If they were natural, such as currents, etc., they certainly have been present substantially unchanged for centuries. Professor Verrill suggests that it may have existed formerly in Nova Scotia, but have "become more diffused in recent times by commerce." But surely there was commerce between Nova Scotia and New England before 1868 (in which year it was first reported from Maine), and enough of it to satisfy the most exacting demands of this theory. In all probability the rapid diffusion of the shell since 1857 is in a measure due to both of these causes, but the fact that they did not have a like effect before, seems very strongly to show that the shell was not in Nova Scotia for them to spread. The waters which bathe the Atlantic coast of Nova Scotia are carried by the strong Fundy tides across to the New Brunswick and Maine coasts, and if currents had anything to do with carrying *L. palliata* from one continent to Greenland and thence to the other, it should have carried the free-swimming embryos of its ally, *L. litorea*, from the Nova Scotia to the New England coast.

But granting again for a moment that *L. litorea* has existed in Nova Scotia for an indefinitely long time as an indigenous species, we have it existing under conditions very different from those in which it thrives in England, having, as has been shown, no connection with the latter, and yet retaining its specific identity. It is possible for a species to keep its identity in widely separated localities, where the conditions of life are not precisely the same, only by a continuous intercourse between the different localities. This is in all probability the case with *L. palliata*, for we find it ranging freely around the North Atlantic in England, Greenland,[1] Labrador, Acadia and New England, and the agencies which carried it from one land to the other have in all probability been in operation ever since. But with *L. litorea* the case is different; if it existed in Nova Scotia it must have been cut off from all communication with England, and that it should retain its

[1] We have found no list of the shells of Iceland.

specific identity under such conditions is altogether inconceivable.

We have not been able to present any *direct* proof that *L. litorea* did not exist in Nova Scotia before the present century. The testimony of the numerous lists (by independent observers, who could not have overlooked the shell had it been present) of shells on the coast of New England and New Brunswick in none of which occurs any mention of *L. litorea*, the testimony of its absence from the Post-pliocene deposits of other parts of Canada where *L. palliata* (along with which it always exists) has been found, the testimony of the Indian shell-heaps, into which it would certainly have been carried by the same means or for the same purpose as was *L. palliata*, all of these combined afford almost absolute proof that the shell did not exist on the Atlantic coast of America outside of Nova Scotia. If these same tests could be applied directly to Nova Scotia the question would be settled as to whether it occurred there. An early list of the shells of that Province, or careful investigations into its Post-pliocene deposits and Indian shell-heaps, would practically remove all doubt one way or the other. But the former does not exist and the latter has not been made.

It must have existed in Nova Scotia, if at all. But at the same time its absence from Greenland and Labrador, where, in accordance with what we know of the geographical distribution of animals, it ought to occur along with *L. palliata* if it is indigenous; the extreme improbability of its remaining in such a small area without spreading, with causes in existence tending to carry it from a less favorable to a more favorable habitat; and the impossibility of the species remaining isolated from the parent stock in England for an indefinitely long time, and yet in spite of quite a differently conditioned habitat remaining specifically identical with it, all of these facts tend to show that it did not exist even in Nova Scotia. Is not the conclusion warranted then, that *Littorina litorea* is not indigenous to America, but has been recently and artificially introduced from Europe?

ON LEMURINE REVERSION IN HUMAN DENTITION.

BY E. D. COPE.

DESCRIPTIONS of the molar teeth of man, given by anatomists, differ in important respects. Thus F. Cuvier (Dents des Mammifers) states that while the crown of the first superior true molar consists of four tubercles, those of the second and third superior true molars consist of but three tubercles. In the American edition of "Sharpey and Quain's Anatomy" it is stated that the crowns of the superior true molars of man consist of four tubercles, and the same statement is made in Allen's late work on human anatomy.

My observations having shown me that both of these descriptions apply correctly to certain types of dentition, I determined to examine for myself to ascertain, if possible, the extent and value of the variations thus indicated. My interest in the subject had been especially stimulated by the researches among the extinct Mammalia and the results which I had derived from them. These are in brief as follows: First, the quadritubercular type of molar crown illustrated by the first superior true molar of man belongs to the primitive form from which all the crested upper (lophodont) molars of the hoofed placental mammals have been derived; and second, this quadritubercular type of molar has itself been derived from a still earlier tritubercular crown by the addition of a cusp at the posterior internal part of it. This tritubercular molar in the upper series has given origin directly to the superior sectorial teeth of the Creodonta and Carnivora. In the inferior series I have shown that in known placental Mammalia, at least, the primitive molar crown is quinquetubercular or tritubercular with a posterior heel; that this form gave origin to the inferior sectorial tooth of Carnivora by modification; and to the quadritubercular type, corresponding to the superior quadritubercular crown, by a loss of the anterior inner angle and cusp. And from the quinque and quadritubercular types of lower molar crown the various specialized types of the ungulates have been derived.

Considerable significance, therefore, attaches to the question as to whether the superior true molars of *Homo sapiens* are quadritubercular or tritubercular. The inferior molars are also either quadritubercular or quinquetubercular, but less significance attaches to this modification than to that of the superior true molars.

This is owing to two facts, viz., the fifth tubercle is not the anterior inner which completes the anterior triangle of the primitive inferior molar, but is a median posterior, such as is not uncommon in Mammalia of Puerco and Eocene age; and second, because this tubercle is of quite small size and is, therefore, more liable to variation from insignificant causes.

In the nearest allies of man, the anthropoid apes, the superior true molars are quadritubercular, the posterior internal tubercle of the last or third molar being usually smaller than in the other molars in the chimpanzee. The inferior molars are quinquetubercular in the human sense, the gorilla not infrequently adding a sixth lobe on the external posterior margin of the crown. The molars of both series are quadritubercular, with an occasional posterior fifth in the inferior molars, in the Semnopithecidæ and Cebidæ, excepting the genus Pithecia of the latter, where the superior molars are tritubercular. The superior molars of the Hapalidæ are tritubercular. In the Lemuridæ the second and third, and frequently the first superior true molars, are tritubercular. In the Tarsiidæ the superior true molars are tritubercular throughout. The superior molars of the extinct lemuroids differ like those of the recent forms. Thus in Adapis and its allies they are quadritubercular, but in Necrolemur they are tritubercular. In Chriacus (whose reference to the Lemuroidea is uncertain) they are tritubercular, as is the case also with Indrodon. In Anaptomorphus they are of the true tritubercular type. This is the genus of Lemuroidea, which in its dental character most nearly approaches the anthropoid apes and man, as I have elsewhere[1] pointed out. The formula is I. $\frac{2}{2}$; C. $\frac{1}{1}$; Pm. $\frac{2}{2}$; M. $\frac{3}{3}$. The canines are small and there is no diastema in either jaw.

It may be readily seen in consideration of these facts that the appearance of tritubercular superior molars in the genus Homo constitutes a reversion to the lemurs, and not to the anthropoid apes or to the monkeys proper. And among lemurs the reversion is most probably to that type which presents the closest resemblance to Homo in other parts of the dentition. The genus which answers most nearly to this requirement among those at present known is Anaptomorphus.

In studying the dentition of man, I have examined the crania

[1] Report U. S. Geol. Survey Terrs. F. V. Hayden. Vol. III, 1885, p. 245, Pl. xxive, fig. 1, and Pl. xxv, fig. 10; and AMERICAN NATURALIST, 1885, p. 466, fig. 12.

contained in the following five collections: those of the Academy of Natural Sciences of Philadelphia; of the Army Medical Museum of Washington; of the College of Physicians of Philadelphia; of the University of Pennsylvania, and of my own museum. The first of these is especially valuable on account of the negro, Egyptian and Hindoo crania it contains. My acknowledgments are due to the Board of Curators, of which Professor Leidy is chairman, for the opportunity of studying it. The collection of the Army Medical Museum at Washington is especially important on account of the Kanakas, Esquimaux, Peruvians and North American Indians which it possesses. I am under great obligations to its distinguished director, Dr. J. S. Billings, for the facilities which he placed at my disposal. The museum of the Philadelphia College of Physicians contains the collection made by the late Professor Hyrtle, of Vienna, of crania of Eastern and Mediterranean Europeans. In this department it is unrivaled, and I am greatly indebted to the council of the college, and its curator Dr. Guy Hinsdale, for the opportunity of examining it. Some French skulls in the University of Pennsylvania were of value in the investigation. My own collection, though small, contains a number of Maoris, Australians, Tahitians and North American Indians, which have proved to be of importance. Of English and Anglo-American crania I have been able to examine but few of what might be termed the thoroughly amalgamated race. Of the latter there are probably many crania in the war collection of the Army Medical Museum, but how free the race of each may be from foreign intermixture, of course, it is impossible to know. In selecting such as are supposed to be "stock Americans," those of persons with English names have been preferred, although many now true Americans are of German ancestry. In order to increase the list of this class of examinations, I have imposed on the forbearance of my friends by frequent inspections of their dentitions in *ore aperto*.

I suspect that the characters thus obtained will prove of importance in a zoölogical and ethnological sense. They have been already found to be of great fixity, and hence significance, in the lower Mammalia. The only reason why they should be less so in man is that the modification in reverting to the tritubercular molar is a process of degeneracy, and may be hence supposed to be less regular in its action than was the opposite process of building up, or addition of the posterior internal cusp. Some justification for a light estimate of its value may be found in the following tables. But it must be remembered that it is not always possible to determine exactly the race of the person represented by a skull even when care in its identification has been exercised. Emigration and war have constantly rendered races impure, and transplantation on a large scale has in some parts of the earth produced hybrid races. The results of a study of human crania are sure to be more or less vitiated by these circumstances. We obtain averages rather than exact definitions. Nevertheless the extremes of the series of variations are likely to be found to be characteristic of established forms of man, and will thus justify my belief in the value of the characters presented. To ascertain the relation of these variations to the races is the object of the present enquiry.

The cause of the tritubercular reversion belongs to the class of agencies active in evolution of organic types of whose real nature we know little. It can not be said to be due to a contraction of the maxillary arcade, for the Esquimaux and some other peoples which display the tritubercular dentition are not deficient in this respect. Tritubercular molars do not require less length than the quadritubercular, for the external width of the crown is the same in both cases. They require less material, however, than a quadritubercular crown, since a triangle is smaller than a square drawn on the same base line; however in some men of the lower races who present the tritubercular molars, their outline is nearly square. The hypothesis advanced[1] to account for the reduction of the number and quality of human teeth observed in the higher races, as well as for the replacement of the prognathous jaw by the orthognathous, is that such changes are due to a transference of material and of growth-energy from these parts to the superior part of the skull and its contents. The relative superiority of the dimensions of these latter parts in the higher races is supposed to account for the reduction of size of the jaws.

In the following tables the tubercular formulæ are represented by numbers. Only the last three, or the true molars, in each jaw are considered. Tubercles of reduced size are represented by fractions. Thus $\frac{4-4-4}{5-5-5}$ indicates that each superior molar is quadritubercular, and each inferior molar quinquetubercular. This represents the extreme of the series represented by the lowest races. The

[1] Proceeds. Amer. Philos. Soc., 1871, p. 252.

formula $\frac{4-3-3}{4-4-4}$ indicates that the true molars have four, three and three tubercles respectively, and that the inferior true molars have four each. This represents the extreme common among the higher races.

For clearer understanding of these characters they are arranged in the form of a table. Only the principal races are represented, and hybrids, when determinable, are omitted.[1] The characters of the superior molar teeth only are referred to. These are classified under four heads, viz., first, tubercles 4—4—4; second, tubercles 4—4—3½ or 4—3½—3½; third, tubercles 4—3½—3; fourth, tubercles 4—3—3. As already remarked, the extreme types of the series give the most precise indications of race, while the intermediate conditions have a various range.

In the first table the most obvious results are, that only the

	4—4—4	(4—4—?)	4—4—3½, 4—3½—3½, 4—4—3	4—3½—3	4—3—3	Totals,
Totals	17	19	109	44	89	278
Europeans and Europeo-Americans			39	24	56	119
Esquimaux and Chuktchi			6	3	19	28
Hindus			3	1	2	6
Chinese and Japanese		3				3
N. American Indians		1	17	5	8	31
Peruvians		2	9	1	2	14
Negroes and Egyptians	7		16	5		28
Australians and Micronesians	4	13	23	2	2	44
"Malays" (? Nigritos)	6		1	3		10

three lowest races present four tubercles on all the superior molars, and that of those with tritubercular second and third

[1] Mulattoes, Mestizoes, Half-breed Indians, Gypsies, etc., are omitted.

molars, Europeans and their American descendants greatly predominate. Also that of uncivilized races the Malays and Negroes never, and Micronesians very rarely, present this type of dentition, while in the Esquimaux it considerably predominates.

I now give a table of the characters of the superior molars in the Europeans and Europeo-Americans examined. The number is not sufficient for final conclusions; nevertheless there are some indications of value. Some of the one hundred and nineteen dentitions examined are referred with doubt to their respective

	4—4—3½	4—3½—3½	4—4—3	4—3½—3	4—3—3	Totals.
Totals	11	10	18	24	56	119
Europeo-Americans	3	2	3	2	20	30
French	1			1	6	8
Germans and Scandinavians	2	3	3	8	6	22
Greeks and Italians	3	3	7	3	7	23
Western Asiatics		1		2	4	7
Slavs	2	1	5	6	11	25
Majyar				1	2	3
Lapps and Finns				1		1

races. Thus the Europeo-Americans may have been in many instances immigrants, as many such left their bones on the battle-fields of the American Civil war, where many of the crania were picked up. The supposed Germans are largely Austrians, so that some of them may be more or less Slavic or Majyar.

As results we have the following: The tritubercular dentition appears in eleven out of twenty-five Slavs; in seven out of twenty-three Greeks and Italians; in six out of twenty-two Germans and Scandinavians; in six out of eight French, and in twenty out of thirty Europeo-Americans. The only great race which presents a similar high percentage of tritubercular molars is the Esquimaux, where they occur in nineteen out of twenty-eight dentitions. The tendency is most marked in Slavs, French and Europeo-Americans, and is least marked in Greeks and Italians, and in Germans. These two subraces stand in the series between the intermediate type of the North American Indians and the other Europeans. I have seen no English dentitions.

It is important to remember in this connection that the distinguished ethnologist and archæologist, W. Boyd Dawkins, affirms that the earliest inhabitants of Britain and some other parts of Europe were Esquimaux. He refers especially to the men of the caves, whose implements and arts he declares to be identical with those used by the Esquimaux of the present day.[1] As it is evident that the lemurine or tritubercular reversion commenced with the Esquimaux, it may be that in some instances at least its appearance in men of Anglo-Saxon and other European races is due to inheritance alone. But it is reasonable to suppose that in this case, as in other evolutions, the cause which produced this modification of the Esquimaux dentition is still active, and its frequent appearance in the most civilized races may be due to this cause as well. The progressive character of the French dentition in this respect is in broad contrast with the primitive character of that of Italians and Greeks. The characters seen in the latter go far towards sustaining Professor Huxley's hypothesis that the dark Mediterranean subraces consist of a mixture of Egyptian with the Indo-European stock.

In conclusion it may be stated that the tritubercular superior molars of man constitute a reversion to the dentition of the Lemuridæ of the Eocene period of the family of Anaptomorphidæ. And second, that this reversion is principally seen among Esquimaux and the Slavic, French and American branches of the European race.

[1] Early Man in Britain, 1880, p. 233.

EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

—— The statement is often made that teaching and original investigation are incompatible. This is not so; further, we maintain that he who is engaged in advanced studies in any department of science is far better adapted for fulfilling the functions of an instructor, at least in a college, than he who is content to allow others to make his discoveries for him. An instructor, to be thoroughly qualified to instruct, should keep himself thoroughly posted on all the recent discoveries in his province. Unless he be an original investigator he will fail to do so. He will rest content with the text-books and the little he can assimilate by reading abstracts and reviews in the semi-popular scientific journals; he will lack that enthusiasm without which no good results can be expected from the student. The original investigator has that enthusiasm. Without it he could not be compelled to go through all that drudgery which is necessary to produce good results. The student in coming into his presence is at once inspired to work, and to be thorough in his work. The original investigator is forced to keep up with the times. He must keep himself posted as to what is going on the whole world over, in order that he may not waste his time and energies in doing what has already been thoroughly performed. He goes to the bottom of his subject and his pupils may rely upon what he says; it will be the expression of the most recent opinion and will be authoritative so far as it lies in his special line. It may be said he will be narrow, and that he will have an exaggerated idea of the importance of the subject of his own chosen field. To a certain extent this is true, but not so far as one would at first think. All departments of any science are interdependent, and he who is specially engaged in one line is obliged to keep track of what is being done in the others, for he must turn in every direction for hints and comparisons. Some peculiar qualities of some substance described in the papers of some chemical journal may give the physicist just the points he needs to make some experiment a success. Some feature in the structure of a sea anemone may throw light on some problem in the development or the diseases of man. The original investigator is forced to explore every corner and keeps his mind stored with the latest discoveries, while his uninvestigating colleague sees only what chance throws in his way. Which one, other things being equal, will make the better instructor?

RECENT LITERATURE.

MILNE'S EARTHQUAKES[1].—This is a very timely work in view of the recent earthquake at Charleston. For this reason we shall for the use of our readers, abstract some of the leading points relating to earthquakes and their causes, which seem generally accepted and to accord with observed facts. While it is estimated that several earthquakes occur daily throughout the world, reference is also made to the smaller movements called "earth tremors," which occur so constantly that "it would appear that the ground on which we dwell is incessantly in a state of tremulous motion." A typical earthquake, however, consists of "a series of small tremors succeeded by a shock, or series of shocks, separated by more or less irregular vibrations of the ground." After discussing seismoscopes, instruments which are so constructed as to move at the time of an earthquake and leave a record of the motion, as well as seismographs, or record-receivers, earthquake motion is discussed theoretically, Mallet's and Abbot's results being given as well as the results obtained by the author in Japan.

A single shock is, as Mallet states, an impossibility. His statement is quoted as follows: "The almost universal succession of phenomena recorded in earthquakes is, first a trembling, then a severe shock, or several in quick succession, and then a trembling gradually but rapidly becoming insensible."

As the results of observations on the velocity of propagation of an earthquake it appears that in the Tokio earthquake of October 25, 1881, the disturbance must have traveled between Yokohama and Tokio at the rate of 4300 *feet per second*, but from Hakodate to Tokio at a velocity of 10,219 feet per second. Thus Milne concludes from his own observations and those on the Lisbon and other earthquakes, that:

1. Different earthquakes, although they may travel across the same country, have very variable velocities, varying between several hundreds and several thousands of feet per second.
2. The same earthquake travels more quickly across districts near to its origin than it does across districts which are far removed.
3. The greater the intensity of the shock the greater is the velocity.

Multiplied observations show that however chaotic at first sight appears the ruin produced by earthquakes there is in many cases "more or less law governing the positions of bodies which have fallen, the direction and positions of cracks in walls, and the various other phenomena which result from such destructive disturbances."

[1] *Earthquakes and other Earth Movements.* By JOHN MILNE, professor of mining and geology in the Imperial College of Engineering, Tokio, Japan. With thirty-eight figures. New York, D. Appleton & Co. 1886. 12mo., pp. 363.

Darwin tells us that in the earthquake at Concepcion, in 1835, the walls which ranged S. W. by W. and N. E. by E. stood better than those which ranged N. W. by N. and S. E. by S., the undulations coming from the S. W. In Caraccas, "the city of earthquakes," it is said that every house has its *laga securo*, or safe side, where the inhabitants place their fragile property. This *laga securo* is the north side, and it was chosen because about two out of every three destructive shocks traversed the city from west to east, so that the walls in these sides of a building have been stricken broadside on."

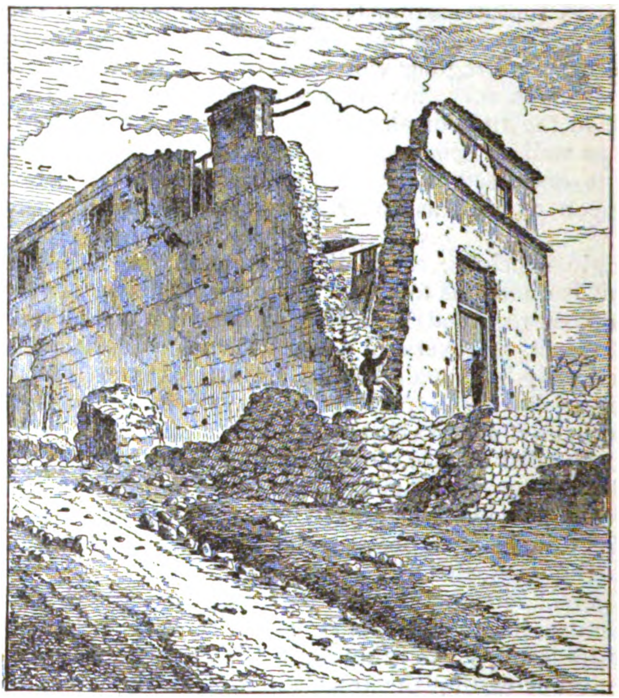

FIG. 1.—The Cathedral at Paterno, struck obliquely by the Neopolitan earthquake of 1857.

Special districts also, in an earthquake country, are free from shocks, since Milne tells us that even in a country like Japan, where there are on the average at least two earthquakes per day, it is possible to choose a place to build in as free from earthquakes as Great Britain. Caverns, wells, quarries, moats and the proximity to ravines and cañons protect a small region from the severe shocks of earthquakes.

Seismic disturbances in the ocean are discussed in the ninth chapter. Among the most striking examples is that of Iquique, Peru. The sea-wave of the Iquique earthquake of May 9, 1877, like many of its predecessors, was felt across the basin of the whole Pacific, from New Zealand in the south to Japan and Kamschatka in the north, and but for the intervention of the Eurasian and American continents would have made itself appreciable over the whole of our globe. At places on the South American coast it has been stated that the height of the waves varied from twenty to eighty feet. At the Samoa islands the heights varied from six to twelve feet. In New Zealand the sea rose and fell from three to twenty feet. In Australia the heights to which the water oscillated were similar to those observed in New Zealand. In Japan it rose and fell from five to ten feet. In this latter country the phenomena of sea-waves which follow a destructive earthquake on the South American coast are so well known that old residents have written to the papers announcing the probability of such occurrences having taken place some twenty-five hours previously in South America. In this way news of great calamities has been anticipated, details of which only arrived some weeks subsequently. Just as the destructive earthquakes of South America have announced themselves, in Japan; in a like manner, the destructive earthquakes of Japan have announced themselves upon the tide gauges of California.

Similarly, but not so frequently, disturbances shake the other oceans of the world. For example, the great earthquake of Lisbon propagated waves to the coasts of America, taking on their journey nine and a half hours.

The complete set of phenomena which may accompany a violent sub-marine explosion is as follows (p. 174):

By the initial impulse of explosion or lifting of the ground, a "great sea-wave" is generated, which travels shorewards with a velocity dependent upon its size and the depth of the ocean; at the same instant a "sound-wave" may be produced in the air, which travels at a quicker rate than the "great sea-wave." A third wave which is produced is an "earth-wave," which will reach the shore with a velocity dependent on the intensity of the impulse and the elasticity of the rocks through which it is propagated. This latter, which travels the fastest, may carry on its back a small "forced sea-wave." On reaching the shore and passing inland, this "earth-wave" will cause a slight recession of the water as the "forced sea-wave" slips from its back.

As these "forced sea-waves" travel they will give blows to ships beneath which they may pass, being transmitted from the bottom of the ocean to the bottom of the ships like sound-waves in water. At the time of small earthquakes, produced, for example, by the explosions of small quantities of water entering volcanic fissures, or by the sudden condensation of steam from such a fissure entering the ocean, aqueous sound-waves are produced which cause the rattling and vibrating jars so often noticed on board ships.

But out of 15,000 earthquakes observed on coast lines, only 124 were accompanied by sea-waves. Out of 1098 recorded on the west coast of South America only nineteen are said to have been accompanied by sea-waves; but from additional facts stated, almost every severe earthquake on that coast has been accompanied by considerable agitation in the neighboring sea.

"On April 2, 1851, when many towns in Chili were destroyed, the sea was not disturbed. At the time of the great earthquake of New Zealand (June 23, 1855), although all the shocks came from the sea, yet there was no flood. The small shock of February 14, however, was accompanied by a motion in the sea." To these facts, taken from Fuchs' work, our author adds the fact that the

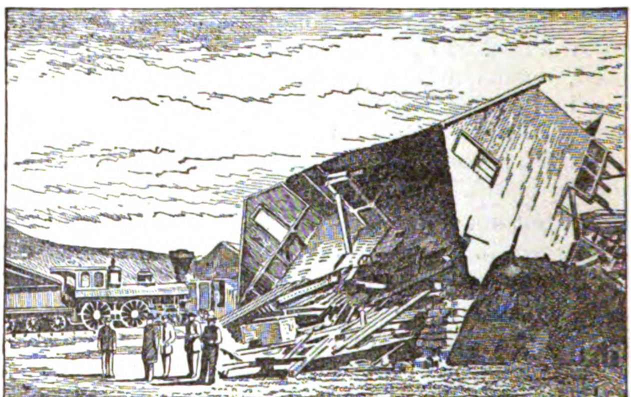

FIG. 2.—Stud mill at Haywards, California, swung completely over.

greater number of disturbances which are felt in the northeastern part of Japan, although they emanate from beneath the sea, do not produce any visible sea-waves. They are, however, sufficient to cause a vibratory motion on board ships situated near their origin.

It has been long known by physicists that the velocity with which a given wave is propagated along a trough of uniform depth, holds a relation to the depth of the trough; hence calculations of the average depths of the Pacific, dependent on the velocity with which earthquake waves have been propagated, have been made by many investigators, but Milne thinks these are open to criticisms in consequence of the writer having assumed that the wave originated on a coast line, when the evidence clearly showed that it originated some distance out at sea. As an example of such calculations we copy Milne's account of the wave of 1868:

"On August 11, 1868, a sea-wave ruined many cities on the

South American coast, and 25,000 lives were lost. This wave, like all the others, traveled the length and breadth of the Pacific.

"In Japan, at Hokodate, it was observed by Captain T. B. Blakiston, R. A., who very kindly gave me the following account:

"On August 15, at 10.30 A.M., a series of bores or tidal-waves commenced, and lasted until 3 P.M. In ten minutes there was a difference in the sea level of ten feet, the water rising above high-water and falling below low-water mark with great rapidity. The ordinary tide is only two and a half to three feet. The disturb-

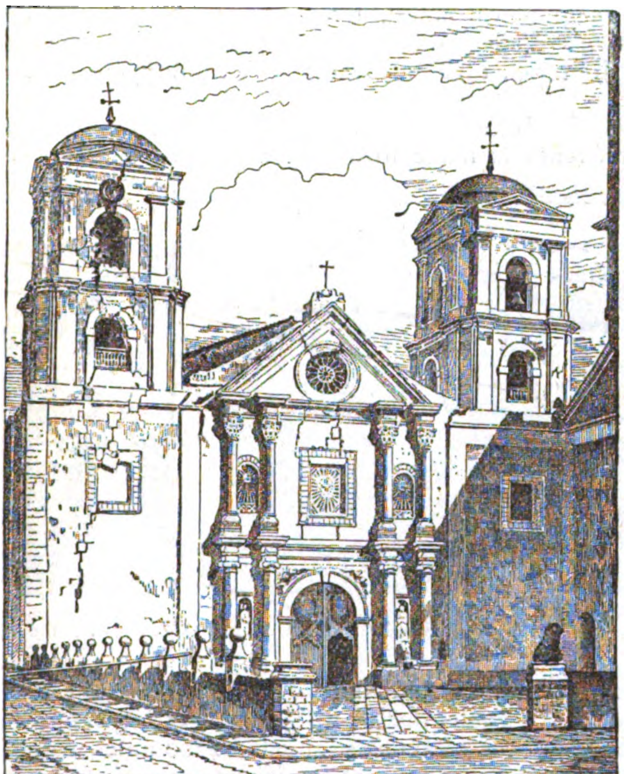

FIG. 3.—Church of St. Augustine, Manilla. Earthquakes of July 18–20. 1880.

ance producing these waves originated between Iquique and Arica, in about lat. 18°28′ S. at about 5 P.M., on August 13. In Greenwich time this would be about 13 h. 9 m. 40 s., August 13. The arrival of the wave at Hakodate in Greenwich time would be about 14 h. 7 m. 6 s., August 14; that is to say, the wave took about 24 h. 57 m. to travel about 8700 miles, which gives us an average rate of about 511 feet per second. These waves were felt all over the Pacific. At the Chatham islands they rushed in with such violence that whole settlements were destroyed. At the Sandwich islands the sea oscillated at intervals of ten minutes for three days."

Comparing this wave with the one of 1877 we see that one reached Hakodate with a velocity of 511 feet per second, whilst the other traveled the same distance at 512 feet per second.

Other practical problems are the determination of earthquake origins and the depth of an earthquake centrum, discussed in Chapters x and xi. From Mallet's calculations the greatest possible depth of any earthquake shock is limited to about thirty geographical miles, but Milne adds that the origin of the Owen's Valley earthquake of March, 1872, was estimated (Amer. Jour. Sc., 1872) as being at least fifty miles below the surface.

Under the head of distribution of earthquakes in space and time, reference is made to a map which does not appear in our

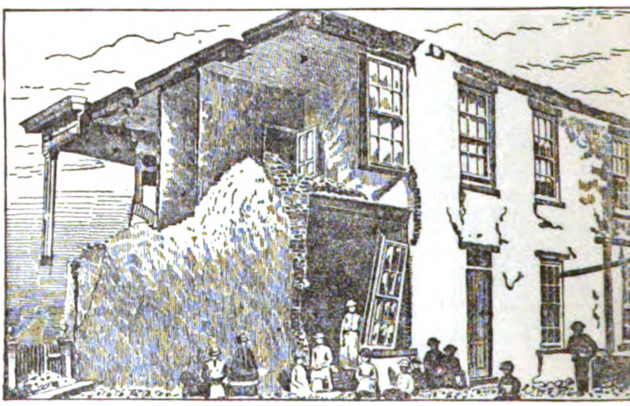

FIG. 4.—Webber House, San Francisco, Oct. 21, 1868, showing the effect produced on an end building.

copy of the book. As an example of the vast area over which an earthquake is sensible, that of Lisbon in 1755 is given, which was felt over an area of 3300 miles long and 2700 miles wide, "but in the form of tremors and pulsations it may have shaken the whole globe." Earthquakes chiefly occur in volcanic and mountainous regions. "Looking at the broad features of the globe, we see on its surface many vast depressions. Some of these saucer-like hollows form land surfaces, as in Central Asia. The majority of these, however, are occupied by the oceans. Active volcanoes chiefly occur near the rim of the hollows which have the steepest slopes. The majority of earthquakes probably have their origin on or near the bottom of these slopes."

As to the frequency of earthquakes Kluge's estimate of 4620 between the years 1850 and 1857, averaging nearly two a day, is thought by our author to be much below the truth, as there may be perhaps ten and perhaps one hundred, it being impossible to state the number definitely.

Milne concludes, after a lengthy discussion of the facts, that the majority of earthquakes are due to explosive efforts at volcanic foci. "The greater number of these explosions take place beneath the sea, and are probably due to the admission of water through fissures to the heated rocks beneath. A small number of earthquakes originate at actual volcanoes. Some earthquakes are produced by the sudden fracture of rocky strata or the production of faults. This may be attributable to stresses brought about by elevatory pressure. Lastly we have earthquakes due to the collapse of underground excavations."

The work concludes with brief chapters on earth tremors, earth pulsations and earth oscillations.

WHEELER'S REPORT UPON THE THIRD INTERNATIONAL GEOGRAPHICAL CONGRESS.—"Better late than never" is the adage which enters the mind upon reading that the congress, the proceedings of which are here reported, was held at Venice, Italy, during the last half of the calendar year 1881. As these geographical congresses are held every five years, this volume just escapes being mistaken for a forecast of the fourth congress. Representatives from twenty-nine nationalities, embracing three-fourths of the earth's inhabitants, were present. The question of a common initial meridian and uniform standard time seems to have been the most prominent matter brought before the attention of the assembled geographers and explorers, but votes were taken upon forty-seven questions. Among these were the exact trigonometrical determination of the position of light-houses, the establishment of subordinate meteorological stations to connect polar stations with those in middle latitudes; the desirability of registering the superficial temperature of the soil; the compilation of a universal phonetic alphabet; the representation of mountains (in elementary atlases) by level curves; the fixation of a universal scheme of coloration for different heights, depths, and kinds of soil, and the preparation of lists of the explorers of each country. The Exhibition was held in seventy-four rooms in the royal palace, and was attended by about 150,000 visitors.

The principal part of the volume is occupied with an account of the Government Land and Marine Surveys of the World, commencing with a summary of the origin, organization, administration, functions, history, and progress of these surveys, with lists of the general and special topographic maps published, etc. Capt. Wheeler states that in all the older civilized countries the topographic survey is the principal one, and that in all large and well organized Governments it has been continuously maintained under military administration. No such survey now exists in the United

States. The topographic and geological surveys of the various countries are next taken up separately, commencing with Great Britain and its colonies. In Asia only one independent country, Japan, seems to have topographic and geologic surveys. Those which were inaugurated by Brazil, the United States of Colombia, Ecuador, Peru, Costa Rica, San Salvador, Guatemala, and Mexico were all stopped at the date of the writing of the report. The maps include one of the world, showing the areas which have been trigonometrically surveyed, a more detailed map of the European surveys, and another of the United States, and several sections from the topographic maps of various European countries. The advantages of the various methods of representing relief can be studied by comparing the hachures illuminated by oblique light of the Swiss atlas with those illuminated by vertical light of that of Russia, and both with the system of curves adopted in the Spanish survey. The section from Siegfried's atlas of Switzerland gives the slighter elevations in curves, the higher in hachures, and fulfills its purpose admirably. In the maps of Saxony curves and crayon shading are used, while in that of France five colors are used in combination with contour lines. There is unfortunately a lack of references to enable one unversed in all the varieties of topographic representation to understand them. The necessity of a consensus on the subject is evident.

THE MORPHOGENY OF THE VERTEBRAL COLUMN IN THE AMNIOTA.[1]—In this brochure of thirty pages Dr. Baur gives a historical review of the opinions of anatomists as to the homologies of the vertebral segments, which are most easily distinguished among the Rhachitomous Batrachia. There have been three different views on this subject, those of von Meyer, Cope and Gaudry. The opinion of Gaudry has been supported by Fritsch and Lydekker. Von Meyer regarded the intercentrum in Archegosaurus as an inferior vertebral arch, corresponding below, to the neural arch above. Cope believed it to be a distinct body, intercalated between the true centra, which he regarded as represented by the two pleurocentra. Gaudry thought that the pleurocentra and intercentrum together form a centrum, and he therefore names Cope's intercentrum "hypocentrum." Dr. Baur shows Cope's view to be the correct one on various grounds. Among these is the double bilateral origin of the true centrum in Vertebra, as shown by Müller, Roseberg, Albrecht and Froriep.

DIE CLASSEN U. ORDNUNGEN DES THIERREICHS IN WORT U. BILD; von J. G. Bronn; Reptilien, fortgesetzt von Dr. C. K. Hoffman.—This important publication is progressing in its various departments, and bids fair to reach an early completion. Many of its departments are contributed by able naturalists. The de-

[1] *Ueber die Morphogenie der Wirbelsaüle der Amnioten.* Von Dr. BAUR. Biologisches Centralblatt, August, 1885.

partment of Reptilia is represented by a considerable amount of matter contributed by Dr. Hoffmann. The anatomical portion of this work is quite thorough, and forms a valuable text-book of the subject. We cannot say as much for the systematic portion. This has been written on the principle of inserting everything without criticism. There has been no consideration of evidence as to a correct representation of nature, and the least expressive models have often been selected. No attention has been paid to questions of synonyms; hence the same genus often appears under different names, occasionally attributed to the wrong author. This portion of the work should have been confided to a more competent person.

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——Ueber den morphologischen Sitz der Hasenscharten Kieferspalte. A. d. Biologischen Centralblatt, 1886.

——Ueber die Vorderflosse von Protopterus annectens. Sitz. d. k. preus Ak. d. Wissensch. All from the author.

Wiley, H. W.—The economical aspect of agricultural chemistry. Address delivered before the A. A. A. S., Buffalo, 1886.

GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

GENERAL.—In a recent number of the Mittheilungen of the Geographical Society of Vienna, Dr. Penck takes issue with the usually accepted proportions of land and water (1 to 2.76), asserting that the unknown regions around the poles are too extensive to permit of any reasonable approach to accuracy in this respect.

M. Rambaud gives the extent and population of the French colonies, or rather possessions. Including Tonkin and Madagascar, these comprise about 1,800,000 square kilometers, and about twenty-four and a half millions of people. In this total the population of the French Congo possessions is not included, and Tonkin is credited with only 12,000,000 of inhabitants. The commerce with these colonies was, in 1883, about 915,000,000 of francs.

Major Feilden, naturalist of the Arctic expedition of 1875–76, has given in his adhesion to the belief that through the secular cooling of our planet the poles became first fitted for the reception of life; that in Palæozoic times the north pole possessed a climate at least as warm as that now experienced at the equator, and that during the Miocene period the temperature, though gradually cooling, supported a flora which spread southwards.

AMERICA.—*The Xingu.*—Petermann's Mittheilungen (Nos. 5 and 6) contains a full account, with maps, of the German Xingu expedition of 1884. The Xingu is formed by the union of three large rivers: the Kuliseii, the Ronuro and the Batovy, the last of which falls into the Ronuro a little above its confluence with the Kaliseii, which may be considered the main stream. The expedition descended the Batovy, which flows in numerous bends through a flat country, but is intersected by many rocky strata forming rapids. After the confluence the Xingu flows through a level country till it reaches 10° S. lat. Here it enters granite hills and forms the Martius cataract. From 10° to 3° the Xingu receives only two important affluents, both from the left. At 3° 40′ begins the great bend of the Xingu, the cataracts upon which were explored by Prince Adalbert of Prussia in 1842–'43. Within this bend the river falls 260 feet. At its confluence with the Amazons the Xingu is a mighty stream nearly five miles wide. The different branches of the Xingu are inhabited by no less than eighteen different Indian tribes, though the total population does not exceed 2,000. The Suya Indians live in beehive-shaped houses with a diameter of thirty-three feet.

American News.—Lake Tahoe is dethroned from its position as the deepest lake upon the continent, Captain Dutton having found a depth of 1996 feet in Crater lake, Oregon. The average depth is about 1490 feet. The shores of this lake are very

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

precipitous, and the same rapid descent continues below the water, so that depths of fifteen to eighteen hundred feet are found all around the margin. It had been previously sounded by Capt. G. M. Wheeler, U. S. Engineers.——M. Charnay has, during his last season of exploration in Yucatan, discovered the remains of a town called Ek Balam, or the city of the black tiger. Also, upon an island about eight leagues north of Campeachy, he found a Maya burial ground which had never before been visited by a man of science.

AFRICA.—*Mozambique.*—The Portuguese are aiding to fill up some of the gaps upon the map of Africa. An expedition to the gold mines of Marica, worked at a time of which no records have reached us, has resulted not only in the formation of a new town, Villa Gouveia, but in theexploration of the lower course of the Aruangua or Pungue, which proves to be navigable for a considerable distance, as are also the Revue and Buzi, the conjoined streams of which enter the ocean slightly to the south of the Pungue. There appears to be a channel connecting the Pungue with the Inhandué, the tributary of the Zambezi upon which the new town is situated. Lake Sungue, which varies much in size according to the season, discharges by the Urema into the Pungue, while the Mucua connects it with the Zangue or lower course of the Inhandué.

A tolerably full description of the Comoro islands is contained in the Revue Scientifique (August 7). The religion is Mohammedan, and the people a mixture of Arabs and Caffres, with Madagascans, etc. The largest island, Great Comoro or Angazia, has a superficies of 1100 kilometers. Moheli is the smallest but most fertile of the group; Anjouan has the best harbor and is most frequented by Europeans, and Mayotte, or Mahore, the most southern and western of the archipelago, belongs to France.

Petermann's Mittheilungen (July) contains an account of the German expedition of 1884–'85 to Angra Pequeña, or Luderitzland. The immediate neighborhood of the settlement is described as a dreary spot where there is scarcely any living thing but snakes and lizards. A short distance to the north are extensive dunes reaching a height of 500 meters. The interior does not appear to be much better. River beds are dry even in winter. Snakes, scorpions and beetles seem to have been the most noticeable objects. Aus and Gubub, east of 16° E. long. and about 26° 40′ S. lat., are the highest points of this part of Africa, the level falling to the south towards Orange river. The scenery here consists entirely of barren table-mountain, between which and the ocean extends a broad sandy plateau. Further to the south a grassy region was found. Dr. Pohle reports an entirely negative result; the want of rain-fall and lack of drinking water unfit the district for colonization; minerals are few, and vegetation is so scarce that man and beast could scarcely be kept alive.

It has been proven that workable deposits of petroleum exist on the Egyptian shore of the Red sea. The material, which has lost its more volatile components, is found at the level of the sea upon piercing the recent coral formation of the foreshore. Col. Ardagh believes that the source of the petroleum is in the older limestone beneath the coral.

M. Aubry, during his visit to Shoa in 1883–'84, surveyed the source of the Hawash and its course for about 190 miles, and also surveyed the Mugueur, a tributary of the Blue Nile.

EUROPE.—*Surveys in the Pyrenees.*—Recent surveys in the Pyrenees, by M. Schrader, aided by the explorations of Dr. Jaubernat, have proved the existence of a lake, the largest on the northern slope of the Pyrenees, in a gap between two chains of peaks, which, approached from opposite sides, had previously been supposed to be identical. M. Schrader states that on the south and south-east of the Aran valley are several ranges, nearly 10,000 feet high, that are unnoted on any geographical map. The Aran valley is tributary to the Garonne.

ASIA.—*Burmah.*—The August issue of the Proceedings of the Burmah Geographical Society contains an interesting account of Burmah, the country and people, by Mr. J. A. Bryce. The topography of the region, the physical and other characteristics of the races which inhabit it, the productions and climate, and the present status of the various nationalties, are discussed. Mr. Bryce fears that the Burman, in spite of that vigor which has enabled him to continue dominant for two thousand years, will succumb to the more energetic Shans and Kakhyens (Singphos), now that his empire has been put an end to by the British. The Burmese occupy the upper part of the Irawadi delta, the upper valley of the Sittang, a narrow space on each side of the Irawadi in Upper Burmah, and the Moo valley, between the Irawadi and the Kyendwin. The Talaings still form the bulk of the population in the delta of the Irawadi and Sittang. The Talaings are smaller, plumper, fairer and less hard-featured than the Burmese, while the Shans are bigger and stouter than the dominant race. Mr. Bryce puts the total population at seven and a half millions, about half of them Burmese.

The Drying up of Siberian Lakes.—The rapid drying up of the lakes of the Aral-Caspian region is not limited to the two great lakes which give their names to it. M. Yadrintseff, in the Izvestia of the St. Petersburg Geographical Society, gives two maps, one representing a group of Siberian lakes, according to a survey made in 1784, the other giving the same lakes as they appeared in 1813, 1820, 1850, 1860, and finally in 1880. The group consisted of three large lakes, Tchany (the largest), Sumy, and Abyshkan, and the small lake Moloki, between Abyshkan and Tchany. The latter lake has greatly dwindled since 1784. Lake Moloki has diminished from twenty miles in length to three; and Lake Abyshkan, in the early part of the century forty miles from north to south and seventeen from east to west, is reduced to three small ponds, the largest scarcely a mile and a half wide. Another lake, Tchebakly, which in 1784 was forty miles by thirty, is also now reduced to three ponds, the largest less than two miles across.

Among the results of the New Zealand earthquake are the addition of 300 feet to the height of Mount Tarawera, and the subsidence of the beautiful Lake Rotomahana, which is transformed into an expanse of seething mud. Its renowned terraces are reported to be destroyed. Large areas are covered with volcanic dust and mud. Lake Rotomahana was the wonderland of the volcanic belt of the North island, as it was surrounded with terraces of silica from which issued hot springs and geysers.

The Transcaspian railway was, on the 14th day of July, opened for traffic as far as Merv. The entire length of the line to Samarcand will be 1335 versts, or 890 miles. Three hundred versts of this is in Bokharan territory. Between Michailovsk, on the Caspian, and Samarcand, there are in all sixty-three stations, several of which have to be supplied with water by pipe-lines or water-trains, while others are provided with artesian wells.

Mr. H. O. Forbes has returned to New South Wales. He was unable to ascend the Owen Stanley range, but reached a point sixty-five miles from Port Moresby.

GEOLOGY AND PALÆONTOLOGY.

A Remarkable Extinct Geyser Basin in S. W. Colorado.[1]—In many features the Yellowstone National Park region is closely paralleled by several other districts. In its geography, and to a large degree in its geognosy, it does not materially differ from a portion of the country adjacent to the elevated "pinnacle," which parts the waters of the Rio Grande, the Arkansas and the Colorado. As early as 1879, my own familiarity with the former area led me to the detection of traces in Southern Colorado of the same action which has marked the later stages of volcanic decadence in the park. Afterwards, from month to month, evidences of this nature multiplied from further researches, until in 1882 it was safe to announce that a considerable portion of the San Juan mining region is covered by the deposits from ancient thermal springs.[2] At this time the peculiar *bonanzas* of the Red Mountain district began to receive attention, and the predictions of the writer, based upon the foregoing conclusions, were invariably verified in the exploitation of the mines. But the development of the ore-bodies and much more detailed examination of

[1] Read before Section E., A. A. A. S., Buffalo Meeting, 1886.

[2] Notes on the geology and mineralogy of San Juan county, Colorado, by Theo. B. Comstock. Published in Trans. American Institute of Mining Engineers, Vol. XI, pp. 165–191 (*with map*).

the area in question, revealed other and more interesting facts concerning the growth of the lodes in this restricted area. It soon became evident that the extremely peculiar topography of the country at the head of Red creek, in Ouray county, could have been produced only by the accumulative action of numerous enormous geysers, far more effective than those to-day at work in the Yellowstone Park, though occupying, perhaps, a less extensive basin. Probably, however, not a little of the area over which the hot spring deposits can be traced, may have been the seat of important geysers. In fact, there are reasons for making this statement more definite, but it will be best to confine ourselves to what can be clearly described in a few words, without consideration of nice structural details.

The upper valley of Red creek is thickly studded with mounds of varying size, but not widely different in form. All these are more or less closely connected with the present (or comparatively recent) local drainage, which is also bounded at irregular intervals by dry pits and pools of cold water quite similar to the bowls of existing hot springs in other localities. The remarkable characteristics of this basin are the number and the magnitude of the mounds and the total absence of active thermal springs, notwithstanding the existence of such in localities not far distant, as at Ouray. The altitude of the district is from about 9500 feet to 12,000 feet, whereas few, if any, of the present hot water bowls are known above 6500 feet, hereabouts.

The cañon of Red creek is undoubtedly not one wholly of aqueous erosion, but the drainage has been induced in part by seismic action, modified in an interesting manner by glacial scorings and subsequent diluvial deposition. The Red Mountain geyser area, as we may designate this tract, is now topographically restricted, as here indicated, almost wholly to the upper portion of this interesting cañon, but it may be really separated into three well-marked basins, which formerly fed as many separate affluents of the main stream. Two of these are proven to be metalliferous, while the third is almost unexplored, though giving indications of similar character, but less promising perhaps.

The geyser areas do not seem to extend beyond the region of maximum intensity of the volcanic action in the rhyolytic period, and the ore-bodies all furnish evidence of secondary reactions taking place in the line of a prominent fault-fissure of that age. All along this course over a considerable breadth of territory, the remains of extinct thermal springs are (recognizably) most abundant, but the geyser character is not noticeable far towards the north or south of Red peak.

The transformations in the vein material, the aggregation of the ores into bonanzas (as at the Yankee Girl, Alaska and Old Lout mines, among others) with the very remarkable distribution of minerals in the lodes, are but a few of the intensely interesting details which can be there studied to the best advantage. Much that is there revealed has already thrown new light upon the origin and life-history of metalliferous deposits, but I cannot now touch upon these topics.[1] The gigantic geyser-mounds are in themselves of marked interest, not only from their great size and external configurations, but also on account of their internal structure as proven by the excavations made in some of them for mining purposes. The American Belle, Grand Prize and other mines were opened directly in mounds of this nature, and (as in many other cases where only ordinary thermal springs probably existed) caverns were invariably entered after passing through an outer shell of considerable thickness. In nearly all of these some connection with the surface was traceable by following the tracks of woodchucks, which had utilized the passages as domiciles. In the caverns, which are sometimes of large dimensions, there is usually a deposit of sulphuretted ores, with allied minerals, with a very considerable amount of yellow and red material resulting from its oxidation and the production of carbonates.

No doubt much valuable information bearing directly upon the life-history of the geyser may yet be gathered from detailed studies in this district. But little real exploration underground has yet been accomplished, and that small amount is but partially known to those who can make the best use of it for scientific purposes. All that the writer has yet observed agrees in most essentials with what may be seen in the extinct subterranean passages at Gardiner's river, Wyoming, except that the metalliferous deposits and the geyseritic relics are peculiar to the Red Mountain area.—*Dr. Theo. B. Comstock, Champaign, Illinois.*

SCHLOSSER ON CREODONTA AND PHENACODUS.[2]—Dr. Schlosser has attacked the problem of the Creodonta with his accustomed skill, and has thrown the additional light of his extensive acquaintance with mammalian anatomy on the subject. His opinion of the affinities of the group are as follows: He regards the Creodonta, with Cope, as a sub-order, but not like him, of an order Bunotheria, but rather with Lydekker, of the order Carnivora. He does not regard them as ancestral to the Carnivora, but as having had a common ancestor with that order. This common ancestor he derives from hypothetical Marsupialia with numerous temporary teeth. He excludes from the Creodonta the Hyænodontidæ and Miacidæ,

[1] The writer has announced these discoveries and given some of his own conclusions in a series of articles puplished in the Engineering and Mining Journal, 1882–84 inclusive, ("Distribution of San Juan county Ores"); in a further series in the same journal, 1884–86, now running ("Metallurgy of San Juan county Ores"); also in the paper previously quoted in Trans. Am. Inst. M. E., and at greater length in the same Transactions, May, 1886 ("Geology and Vein-Structure of S. W. Col.," with four maps).

[2] Ueber das Verhaltniss der Cope'schen Creodonta zu den übrigen Fleischfressern; Morphologisches Jahrbuch 1886, p. 287, von Dr. Max. Schlosser.

regarding both as true Carnivora; the former on account of the supposed scapholunar bone reported by Gervais, the latter on account of the single flesh-tooth. He restricts the Creodonta to those forms which have two flesh-teeth, if any. From the Leptictidæ he excludes the genera Leptictis, Mesodectes, and Ictops, placing them in the Insectivora. He therefore changes the name Leptictidæ to Proviverridæ. Schlosser does not agree to the introduction to the Creodonta by Cope of the tritubercular families usually referred to the Insectivora, viz., the Talpidæ, Chrysochlorididæ, Centetidæ, Mythomyidæ. and Tupæidæ; but he does not give his reasons for this view.

The following remarks may be made on the above positions of Dr. Schlosser. The supposition that Hyænodon possesses a scapholunar bone has been shown by Professor Scott to be an error, so that this form must be retained in the Creodonta, to which it is connected by Pterodon. Specimens of Miacidæ in the Princeton Museum show that this family also possessed no scapholunar bone. This, together with the non-trochlear astragalus which I have described, shows that the Miacidæ must also be referred to the Creodonta. These points admitted, it becomes much easier to believe that the Carnivora are the descendents of Creodonta, through the Miacidæ. (The supposed connection between Oxyænidæ and Felidæ I denied in my last phylogeny in the article on Creodonta in the AMERICAN NATURALIST for 1884.) The exclusion of the three genera above named from the Leptictidæ, (Proviverridæ) has little significance, until the reasons for separating the Creodonta from the tritubercular Insectivora can be shown.

Dr. Schlosser's representation of my phylogenetic views is very inaccurate, owing to a misunderstanding of the dates of publication of my respective papers. The oldest of these is the Vol. III. Report U. S. Geol. Survey Terrs., sent to press in 1879, and not issued until February, 1885. The next in point of date are the illustrated papers on extinct Vertebrata, issued at various times in the AMERICAN NATURALIST. My latest phylogenetic opinions, delivered from fuller material and more mature reflection, were published in a paper on the "Evolution of the Vertebrata, Progressive and Retrogressive," in the February, March and April numbers of the AMERICAN NATURALIST for 1885. In the last of these papers the Lemuroidea are separated from the Bunotheria and placed in the Taxeopoda near the Condylarthra, to which they are allied. This does not include the Mesodonta (Pelycodus), which being unguiculate, remains with the Bunotheria. In the above paper all are derived from carnivorous Marsupialia, in accordance with the view of Hæckel's "Schöpfungsgeschichte."

Dr. Schlosser generously acknowledges, in another page, the prior indication of the ancestry of the Phenacodus and Hyracotherium of the horse line to his own, by Dr. J. L. Wortman in the

Revue Scientifique, Vol. xxxi, p. 705. But these relations had been previously pointed out by myself; that of Hyracotherium in the Palæontology of the Report of the Survey W. of the 100th meridian in 1877; and that of the Phenacodus in the Proceeds. Amer. Philos. Soc., 1881, p. 178.[1]—*E. D. Cope.*

Dollo on Extinct Tortoises.[2]—The distinguished Belgian anatomist, M. Louis Dollo, has recently published two important papers on extinct tortoises from the Eocene formations of Belgium. The theme which gave rise to the first of these, is the description of a new genus and species of Chelydridæ, *Pseudotrionyx delheidi* Dollo. In preparing to do this, the author reviews the classification of the Testudinata in an extremely able manner. He adopts the system of Cope in the main, and in giving his reasons for doing so makes an important contribution to the subject. He differs in some details from the author of that system. Thus he separates Eurysternum from the Chelydridæ as type of a distinct family, because it possesses a fontanelle of the plastron; a character which the reviewer does not regard as of family value. He also unites the Propleuridæ with the Cheloniidæ, but as we shall see, he reëstablishes it as a sub-family in the second paper quoted, without apparently being aware of the fact.

M. Dollo somehow supposes that the author of the system he adopts regards the plastron of the Testudinata as homologous with the sternum of other Vertebrata, and also that the names he employs for the elements of the plastron are original with him. This is an error. The terms "postabdominal," etc., were introduced by the distinguished English anatomist, W. K. Parker, and the author criticised by M. Dollo, has stated in one of his papers, on which I cannot at this moment place my hand, that he adopts the views as to the homologies of the plastron, held by that authority. But M. Dollo thinks that the names Dactylosterna, Clidosterna and Lysosterna imply the erroneous homology with the sternum, and should therefore be charged. He then names these divisions Dactyloplastra, etc. Now names ought not to be changed without better reasons than those offered by M. Dollo, for the well-known *opprobrium scientiæ* is the multitude of names. Those in question were not given under an erroneous idea, but the word "sterna" was used figuratively, just as it is in many genera of the order. As well might M. Dollo change the generic names Eurysternum, Pleurosternum, etc., into Euryplastron, Pleuroplastron, etc. And this our author has not yet done.

The plates called intergular by me in Baëna appear to me to be homologous with the corresponding plates in Pleurodira, although

[1] Also in Naturalist for 1881, p. 1017.

[2] Premiére note sur les Cheloniens du Bruxellien de la Belgique; (Bull. Mus. Roy. Belgique 1886, p. 75). Premiér Note s. l. Cheloniens Landeniens de la Belgique; (l. c. 1886, p. 129).

M. Dollo thinks not and finds occasion for the creation of a new name. Adocus, another Cryptodire genus, has a single one well developed.

In his second article M. Dollo separates certain species referred by Professor Owen to the genus Chelonia, as representatives of another genus which he names Pachyrhynchus. It is characterized by the underroofing of the posterior nares, and by the great extent of the mandibular symphysis. He regards this character as requiring the creation of a sub-family of the Cheloniidæ, the Pachyrhynchinæ. The present writer has, however, described the same characters in two genera referred by him to the Propleuridæ (Euclastes and Lytoloma) and has referred to one of the European species (*Chelone planimentum* Owen—Pachyrhynchinæ Dollo) as presenting this character.[1] M. Dollo's genus is probably one of the American forms, and his Pachyrhynchinæ is the Propleuridæ Cope. M. Dollo's family characters are, however, better than those given by Cope.—*E. D. Cope.*

Geological News.—*General.*—M. Steinman recently gave to the Swiss Society of Natural Sciences an account of his explorations in the Southern Cordillera. The fossil fauna and flora are almost identical with those of European formations. The Upper Trias, Rhætian, Lias, Jurassic and Cretaceous are well reprerented.——Montpellier-le-Vieux, a city of eroded rocks, situated twelve kilometers from Millau, in the department of Aveyron, France, seems, according to a note of M. E. A. Martel, to be in some respects even more wonderful than the Garden of the Gods or Monument Park. A mass of rocks, sixty to eighty meters high, simulates an embattled donjon, and is called the citadel. Around this, five depressions, 100 to 124 meters deep, seem in one spot to form an amphitheater, in another a necropolis, in another part an open plaza, and again a city with narrow streets, obelisks, gates, etc., recalling Pompeii, Karnac or Persepolis. The whole is surrounded by a rocky wall exteriorly, 100 to 150 meters high; ravines passing through the talus of this simulate ditches, and outside of all this many groups of ruined rocks constitute a ceinture of detached forts.——J. Stirling has recently contributed to the Linnean Society of New South Wales a paper on further evidences of glaciation in the Australian Alps. The author and Dr. Lendenfeld found erratics, perched blocks, smoothed surfaces and old moraines upon Mount Bogong, the highest mountain in Victoria.

Silurian.—M. Hebert, who has for a considerable period been occupied with the study of the most ancient sedimentary rocks of the northwest of France, has come to the conclusion, that in Northern Brittany and Western Normandy the vertical slates (phyllades) of Saint Lo are at the base, while upon them lie the

[1] Transactions American Philosophical Society, 1870, pp. 146–8.

almost horizontal purple conglomerates, schists and red sandstones.——W. S. Ford (Amer. Jour. Sci. June, 1886) describes *Obolella desiderata* Billings, under the name of Billingsia, on account of peculiarities of the ventral valve which he considers generic.——A. M. Seely (Amer. Jour. Sci., July) describes three new species of sponges of the genus Strophochetus, and notes the distribution of the genus through the Middle Chazy.——Professor N. S. Shaler contributes to the same issue an account of the geology of Cobscook Bay district, Maine. The uppermost beds of the series contain fossils which he refers to the Devonian, possibly to the Ohio shale. Below these are beds which seem to belong to the Niagara and Clinton horizons, while the most numerous list of fossils seems to be of Lower Helderberg horizon. The series is less rich in organic forms than that of the St. Lawrence or of Central New York. The land area of this fiord region is principally occupied by intrusive volcanic rocks.

Tertiary.—M. Cotteau, in his last memoir upon fossil Echini, enumerates fifteen species of Brissopsis.——Mr. Clement Reid has recently studied the Pliocene deposits at Diest and Antwerp, after which he examined the deposit of ironstone at Lenham, England, the fossils in which were, in 1857, referred to the Pliocene by Professor Prestwich. The examination resulted in a thorough confirmation of Professor Prestwich's identification, which had been disputed. There is not a single Eocene species; with two or three exceptions all are known Pliocene forms, but many are represented by species now living in the Mediterranean.——Dr. Otto Meyer contributes to the Amer. Jour. Sci., July, 1886, some observations on the Tertiary and Grand Gulf strata of Mississippi. His conclusions are (1) that in no place can Grand Gulf strata be seen in superposition over the marine Tertiary; (2) that there are two places where strata undistinguishable from Grand Gulf can be seen overlaid by marine Tertiary; (3) that the Grand Gulf formation is mainly not marine; (4) that a thick and extended marine green-sand formation with a Claibornian fauna, approaching the Jacksonian, is found in Eastern Mississippi.

Post-tertiary.—M. A. Gaudry recently exhibited to the Paris Academy of Sciences a reindeer's antler pierced with a large hole, and covered with well-executed carvings. One face shows two seals, a fish (salmon or trout) and three twigs of plants. One of the seals seems to be *P. vitulina.* On the other face are two eel-like slender animal figures, three indeterminable animals (alike) and an insect. This fragment of the reindeer age was discovered by M. Poignon in the Montgaudier caves, department of Charente.——A valuable paper upon the post-Tertiary elevation of the Sierra Nevada, as shown by the river beds, has been contributed by Professor Jos. LeConte to the American Journal of Science. The cañons of California, cut far below the ancient river-beds, are correlated with the features of the plateau region to prove a great elevation which was permanent, while the drift and river deposits of the eastern region prove subsidence after Tertiary times.

BOTANY.[1]

How shall Botany be taught in Agricultural Colleges?—Numerous factors enter into the problem, such as the size of the class, the age and preparation of the students, the season of the year, the length of the college term, the probability of subsequent study, the means of illustrations which can be commanded and many other similar considerations. All of those factors are so different and so variously combined, that a method, which on the whole might be the best in some particular case, might not be the best in any other case whatever.

Roughly classified, we may make out three different methods of teaching botany now in vogue; these may be termed the text-book method, the lecture method and the laboratory method.

It is fashionable now-a-days to decry the text-book method as altogether out of date, but in the hands of a competent teacher a good text-book is a most valuable aid. The lecture method is necessary in very large classes, but satisfactory results are rarely reached, even with the aid of copious means of illustration and a fairly good work of reference in the hands of the student. Nor is the laboratory method, pure and simple, altogether free from objection. Left largely to himself to find out important facts in regard to the specimens he is given to study, the student is sure to go astray and waste much time, a loss needless and inexcusable.

A judicious combination of the methods named would in all probability secure the best results in a majority of cases.

Let me suppose the class to number from thirty to forty, composed of young men of average attainments and ability, and that from three to five hours per week for a year is to be given to the subject. A desirable time for beginning the work of instruction is at the opening of the winter term, which in most colleges is soon after New Year's. For the first term the object is to gain a general view of plants and plant-life. The basis of the instruction should be lectures or talks, occupying a part of the hour, which the teacher can vary according to the needs of the class. An excellent accompanying text-book is Bessey's Essentials of Botany, from which pages may be occasionally assigned as a lesson to be carefully learned. Every subject taken up should be copiously illustrated with specimens which the student is to see and examine for himself. Occasional days are to be set aside for careful reviews of subjects already studied, and from time to time opportunity should be afforded for the examination of specimens under the microscope.

[1] Edited by Professor Charles E. Bessey, Lincoln, Nebraska.

The special advantage of this method of instruction here suggested is two-fold: First, its flexibility; and second, the opportunity it affords for the effective use of the black-board. Figures and diagrams, drawn before the class, in which various phases of development can be shown, are far more valuable than any text-book figure, or previously prepared diagram. Nor should the advantage of giving out suitable topics or problems for the members of the class to examine and report upon, be overlooked. The skillful teacher will find no difficulty in assigning appropriate subjects, which will require independent observation and thought on the part of the student.

A term's work of this kind should give such a comprehensive view of plants as to make subsequent studies to the highest degree valuable and effective.

A second term may be devoted mainly to the higher plants. By this time the spring has so far advanced that an abundance of material for all sorts of works may be obtained. The basis of instruction may still be in the form of familiar lectures, but Gray's Lessons may be used and carefully studied. The instruction should be so planned that the work in class-room and out shall require a large amount of observation and study of plants themselves. Some time may be devoted to the identification of species, not that the name of the plant is the object sought, but that the work in question cannot help but increase the knowledge of the student in regard to the structure of plants, their differences and resemblances. A special study of particular subjects may be made, such as pollination, and the variations in structure and development relating thereto. Certain natural orders may be more carefully studied, and written descriptions and figures of some species or genera, made from the student's own observation, may be required. Some work also in the preparation of herbarium specimens, if thoroughly well done, is always profitable.

A third term may be given to questions relating to the physiology of plants. I do not know of any subject more important to an agricultural student than this. The instruction here must be largely in the form of lectures. Goodale's Physiological Botany is a most admirable work. It is perhaps too comprehensive to be used as a text-book in ordinary classes, but would be serviceable as a work of reference. Some well arranged laboratory work in the histology of plants is very desirable as a part of the instruction in the subject now under consideration. A special effort should be made on the part of the teacher to illustrate his instruction with as many experiments as possible. Many of these must be commenced long before they are needed for use in the class-room. One actual experiment which the class can see, is worth a large number of mere descriptions of experiments. Nor is it difficult to devise, in a fairly equipped laboratory, especially if a greenhouse is also available, a large number of experiments, which the student can himself conduct, make his own observation and prepare a report of the results.

To my mind the scheme which I have here outlined rather than described, suggests at least a desirable method of teaching botany under the limitations named. It is capable of a great deal of modification as circumstances demand, and in the hands of a skillful teacher is likely to produce satisfactory results. In case the instructions end with the year, the student has acquired as large and useful a knowledge of plants as could reasonably be expected; and if he is to continue his studies further, he has an excellent foundation for thorough work in special subjects.

I think we are all agreed there is no royal road to learning; and I am sure that to no subject is this truth more applicable than to botany. And in conclusion I would suggest that the value of any method of instruction may be tested, first, by the extent and accuracy of observation which it calls forth on the part of the student, and second, and chiefly, by the amount of earnest and thorough work which it leads him to do.—*Professor A. N. Prentiss, in American Horticulturist.*

Botanical News.—A most important paper is now in course of publication in the Journal of the Linnean Society, beginning with the first number of Vol. xxiii. It is an "Enumeration of all the plants known from China proper, Formosa, Hainan, the Corea, the Luchu archipelago, and the island of Hong Kong, together with their distribution and synonymy," and will bear the title of "Index Floræ Sinensis." It is the joint work of Francis B. Forbes and William B. Hemsley. Already one hundred and sixty pages have appeared, covering the enumeration from Ranunculaceæ to Leguminosæ. A fine map of the region accompanies the work.——Thomas Morong's paper on the "Naiadaceæ in the Torrey Herbarium," published in the September number of the Torrey Bulletin, is a most useful one. It enumerates seventy-three species, of which *Potamogeton wrightii*, *Zannichellia indica* and *Zostera marina* L., var. (?) *latifolia* are described for the first time.——In the same journal Dr. Vasey publishes a synopsis of the genus Paspalum which will prove valuable to graminologists. Twenty-six species are described.——A late number of the Gardener's Chronicle (Sept. 4) contains an excellent wood-cut of the nut-pine of Colorado (*Pinus edulis*) from a drawing by Sir J. D. Hooker. It is accompanied by a short descriptive note.——The September Botanical Gazette is an "Association number," containing articles on the botany of the recent meeting of the American Association for the Advancement of Science, the Botanical Club of the association, with an installment of the papers, and numerous notes and notelets.

ENTOMOLOGY.

Kraepelin on the Organs of Smell in Arthropods.[1]—To Leydig it was first given to make a decided step in advance. In different writings[2] had this naturalist busied himself with the integumental structures of Arthropods, and declared Erichson's view as to the olfactory nature of the antennal pits as the truest, before he, in his careful work on the olfactory and auditory organs of crabs and insects (14), gave excellent representations of the numerous anatomical details which he had selected from his extensive researches in all groups of Arthropods. Besides the pits which were found to exist in Crustacea, Scolopendræ, beetles, Hymenoptera, Diptera, Orthoptera, Neuroptera and Hemiptera, and which had only thus far been regarded as sense-organs, Leydig first calls attention to the widely-distributed pegs and teeth, also considering them as sense-organs. "Olfactory teeth," occurring as pale pegs, perforated at the end, on the surface of the antennæ of Crustacea,[3] Myriopoda, Hymenoptera, Lepidoptera, Coleoptera, are easily distinguished, and besides the "olfactory pegs" of the palpi, may be claimed as organs of smell. The nerve-end apparatus first discovered by Hicks in the halteres and wings, Leydig thinks should be ranked as organs of hearing.

Regarding the Crustacea, Leydig, in his latest work,[4] gave a lasting explanation of the nature of the pale peg or cylinder on the end of the antennæ which he found in new groups of this class, which was adopted by a large number of naturalists. Thus Claus,[5] in his different essays, expressed the view that these Leydigian organs had the function "of making sensible slight changes in the chemico-physical condition of the water." Indeed, in his later essays[6] he without hesitation calls the structures in question "olfactory teeth," while he at the same time offers a series of anatomical data on the finer structure of the same. Entirely

[1] Translated by A. S. Packard. Concluded from p. 894.

[2] *Leydig:* Zum feineren Bau der Arthropoden, Müller's Archiv, 1855, 376–480; Zur Anatomie der Insekten, Archiv für Anatomie, 1859, pp. 35–89 and 149–183; Lehrbuch der Histologie, 1857, 220.

[3] These pegs, as occurring in Asellus and Daphnidæ, had already been well described, in 1860, in his monograph "Naturgeschichte der Daphiden," Tübingen, 1860, without, however, a discussion of the question whether they were olfactory organs.

[4] *Leydig:* Ueber Amphipoden und Isopoden, Zeits. f. w. Zoologie, XXX, 1878, 225–274.

[5] *Claus:* Ueber die Organization und Verwandtschaft der Copepoden, Würzburg, 1862, 19; Die freilebenden Copepoden, Leipzig, 1863, 55.

[6] *Claus:* Entwicklung, Organization und Systemat. Stellung der Arguliden. Zeit. f. w. Zool., 1875. Zur Kenntniss der Organization und des feineren Baues der Daphniden, etc. Zeits. f. w. Zool., 1876. Zur Kenntniss des Baues, und der Organization der Polyphemiden. Denkschr. d. Wiener Akad. wiss. Math. Naturw. Classe, 1877, XXXVII, 245. Der Organismus der Phronimiden, Wien, 1879, 10.

in the same direction do Sars,[1] Weismann,[2] Rougemont,[3] Gamroth,[4] Hoek,[5] Haller[6] and others more or less decide upon the olfactory nature of the organ of Leydig.

Jourdain (40) does not accept this opinion, and Wrzésniowski[7] adopted the views of Milne-Edward and La Valette. The "calceoli" of Amphipoda might be regarded as organs of smell.

There was still some opposition to Leydig's opinion that in the insects the sense of smell is localized in the antennæ (teeth and pits), and here the work of Hensen[8] might be mentioned, which in 1860 had a decided influence upon the conclusion of some inquiries.

Thus Landois (15) denied that the antennæ had the sense of smell, and declared that the pits in the antennæ of the stag beetle were auditory organs. In like manner Paasch (16) rejected Leydig's conclusion, while he sought to again reinstate the old opinion of Rosenthal as to the olfactory nature of the frontal cavity of the Diptera. In spite of the exact observations and interesting anatomical discoveries of Forel[9] in ants, made in 1874, there appeared the great work of Wolff on the olfactory organs of bees, in which this observer, with much skill and acuteness, sought to give a basis for the hypothesis of Kirby and Spence that the seat of the sense of smell lay in the soft palatine skin of the labrum within the mouth. Joseph (18), two years later, drew attention to the stigmata as olfactory organs, referring to the olfactory girdle, and Forel[10] sought by an occasional criticism of Wolff's conclusions to prove experimentally the olfactory function of the antennæ; but Graber,[11] in his much-read book on insects, defended the Wolffian "nose" in the most determined way, and denied to the antennæ their so often vindicated faculty of smell. In 1879 Berté (52) thought he had observed in the antenna of the flea a distinct auditory organ, and Lubbock[12] considered the organs of

[1] *Sars:* Histoire naturelle des Crustacés d'eau douce de Norvège, Christiania, 1867.

[2] *Weismann:* Ueber den Bau und der Lebenserscheinungen der Leptodora hyalina, Zeits. f. w. Zool., XXIV.

[3] *Rougemont:* Naturgeschichte des Gammarus puteanus, München, 1875, 9.

[4] *Gamroth:* Beiträge zur Kenntniss der Naturgeschichte der Caprellen, Zeits. f. w. Zool., XXXI, 1878.

[5] *Hoek:* Carcinologisches in Tydschr. d. Md. Dierk. Vereen. Deel, IV, 102.

[6] *Haller:* Der Læmadipodes filiformes, Zeits. f. w. Zool., XXXIII, 1880, 368.

[7] *Wrzésniowski:* Vorl. Mittheilung über einige Amphipoden. Zool. Anzeiger, 466, 1879.

[8] *Hensen:* Das Gehörorgan der Decapoden. Zeits. f. w. Zool. XIII, 1863. Das Gehörorgan von Locusta. Zeits. f. w. Zool. XVI, 1886.

[9] *Forel:* Les Fourmis de la Suisse. Neue Denkschr. Allg. Schweiz. Gesellsch. f. d. ges. Naturw. XXVI, 1874. 118, 144.

[10] *Forel:* Der Giftapparat u. d. Anal-drüsen der Ameisen. Zeits. f. w. Zool. XXX. Suppl. 60.

[11] *Graber:* Die Insekten, München, 1877.

[12] *Lubbock:* On some points in the anatomy of ants. Monthly Micr. Journ., 1887, 121–142.

Forel in the antennæ of ants as a "microscopic stethoscope." In 1879 Graber described a new otocyst-like sense-organ in the antennæ of flies (20) which was accompanied by a complete list of all the conceivable forms of auditory organs in Arthropods. In this work Graber described in Musca and other Diptera closed otocysts with otoliths and auditory hairs, as Lespè had previously done. But Paul Mayer, in two essays (21, 53) refuted this view in a criticism of the opinion of Berté, referring the "otocysts with otoliths" to the well-known antennal pits into which tracheæ might pass. Mayer did not decide on the function of the hairs which extend to the bottom of the pits; while in the most recent research, that of Hauser (22), the author again energetically contended for the olfactory function of the antennæ. Both through physiological experiments and detailed anatomical investigations Hauser sought to prove his hypothesis as Pierret, Erichson, Slater, and others had done before him, besides working from a Darwinian point of view. In a purely anatomical aspect, especially prominent are his discovery of the singularly formed nerve-rods in the pits and peg-like teeth of the Hymenoptera and their development, as well as the assertion that numerous hairs in the pits described by Leydig, Meyer, etc., should be considered as direct terminations of nervous fibers passing into the pits. In the pits he farther, with Erichson, notices a serous fluid, which may serve as a medium for the perception of smells. Among the latest articles on this subject are those of Künckel and Gazagnaire (41) which are entire anatomical, while the latest treatise of Graber on the organs of hearing in insects[1] opposes Hick's theory of the olfactory function of the nerve-end apparatus in the halters, wings, etc., and argues for the auditory nature of these structures. Finally, experimental researches by Voges on the seat of the olfactory organs are only known to the writer by a notice in the "Täglichen Rundschau."[2] According to this observer the sense of smell is not localized, but spread over the whole body.

Coxal Glands in Spiders and perhaps Insects.—Professor P. Bertkau reports that in a specimen of Atypus he has been able to find a distinct efferent duct for the coxal gland; it is surrounded by the same fibrous plexus as the gland itself; in six other specimens the duct was not to be found, though the orifice was seen. This rare phenomenon may either be explained by supposing that there was an abnormal retention of an organ which is in other cases absorbed, or, it may be suggested, that in adult examples the efferent duct is regenerated from time to time, in which case the coxal gland would not be a rudimentary organ, but one that is intermittently functional; the constant presence of the orifice is an argument in favor of the latter hypothesis. It

[1] *Graber:* Ueber die Chordotonalen Sinnesorgane der Insekten. Archiv. f. mikrosk. Anat. xx, 506–640. xxi, 65–145. 1881, 1882.
[2] Tägliche Rundschau. Zeitung für Nichtpolitiker, 1882, September (?).

is important to note that the orifice appears on two segments, for this indicates a repetition of the glandular organ, and is *pro tanto* a support to the view of Ray Lankester, that the coxal glands of Arachnids and of Limulus, are the homologues of the segmental organs of Peripatus. The author suggests that the gland at the sides of the prothorax of *Anisomorphus buprestoides*, and those found by Scudder in the Phasmidæ, are possibly representatives of the same gland. In *Mantis religiosa* there is a coiled gland at the hinder side of the fore leg.—*Journ. Roy. Micr. Soc., June, 1886.*

Heart of Insects.—Miss Olga Poletajura finds that the heart of Bombus is composed of five separate tubes, which form the chambers of the organ, and that the most anterior of these is continued into the aorta. Each tube narrows anteriorly so as to have the appearance of a truncated cone, while the walls become thinner; posteriorly it enlarges; the anterior end passes into the posterior in front, and each anterior end is so flattened laterally as to form a vertical cleft; the cardiac tubes are thus only united with one another at two points; the free portion forms a duct (ostium) by which the blood from the abdomen enters the heart; the internal surface of the anterior tube, and the external surface of the posterior form pouch-like safety-valves which regulate the movement of the blood. The heart of Cimbex is formed in essentially the same way as that of Bombus. The writer points out the differences between the accounts now given and those of such entomologists as Strauss, Newport, and Graber, and describes the mode by which the heart appears to perform its function; contrary to the opinion of Strauss, the first chamber does not function alone, as the propelling agent and the ostia are not perfectly closed, so that part of the blood does return to the abdominal cavity.—*Zool. Anzeig., ix (1886), pp. 13–5.*

Migrations of the Ajax Butterfly.—During the fore part of June, 1886, unusual numbers of the Ajax butterfly *(Papilio ajax)* migrated through this city. Since the only feeding places accessible to them in Chicago at this point are scattered lots where a few bunches of clover or dandelion make up the principal flowering plants, the butterflies made few if any stops at these, but flew along the streets near the ground at a rapid rate northward, and it was with considerable difficulty that a single specimen was secured. On June 12th a visit was made at Wood Lawn, Ill., a few miles south of Chicago, where the butterflies were found quite as plentiful, and showed the same uneasiness in their flight. In a cleared grassy spot in the woods near at hand, white clover had spread its blossoms in broad patches where occasionally a butterfly would make a hasty stop, which, however, was only for a moment, when its form would again be seen disappearing through the woods. One of these specimens, after many futile attempts was caught, but was badly spoiled and thrown away, which, by mere chance, fell on the ground with its wings extended. A few minutes later it was noticed that the insects that flew by were sensibly attracted by this dead insect, which they endeavored to make known by their occasionally alighting directly upon the dead body of their fellow.

Thus noticing the decoying effects of the insect, a number after being chloroformed were set apart as decoys pinned upon the ends of twigs which were stuck in the ground. The effect was quite remarkable; hardly a single butterfly would pass the sight without alighting among them, and became an easy prey to the net. In this way a large number of beautiful specimens were taken which would otherwise have been quite difficult to capture. —*Joseph L. Hancock.*

ENTOMOLOGICAL NOTES.—At the June meeting of the Entomological Society of Washington, Mr. Lugger mentioned the fact that the seeds of the hard maple, so numerous in the Smithsonian grounds, were this year uniformly sterile. He attributed this phenomenon to the inclement weather during the flowering season, which prevented bees from visiting the flowers. He also farther described the mode of fertilization of the common lady's-slipper (*Cypripedium acaule*) by a species of Andrena.—— Mr. Lugger also remarked that a few specimens of the European *Aphodius erraticus* were first found by him in 1878 near Baltimore. Since that time the species has spread and is now so common that it has actually replaced the formerly common *Aphodius fimetarius.*——Mr. J. B. Smith describes and figures, in Entomologia Americana (No. 4), the scent-organs of *Leucarctia acræa* and *Pyrrarctia isabella*, which are thrust out between the 7th and 8th segments of the abdomen of those moths. Similar organs have been observed by Morrison in *Agrotis plecta* and *Euplexia lucipara*, and Dr. Riley has observed them in *Aletia xylina.*

ZOÖLOGY.

CLASSIFICATION OF SPONGES.—Professor W. J. Sollas (Scientif. Proc. Roy. Dublin Socy., v. 1886) thus arranges the sponges:

Class I. Plethospongiæ.
  Sub-class I. Hexactinellida.
  Sub-class II. Desmospongiæ.
  Sub-class III. Myxospongiæ.
Class II. Calcispongiæ.

The great majority of the sponges, as will be seen, belong to the Desmospongiæ. The Myxospongiæ are not regarded as a degenerate group. Sollas resents (Zool. Anzeiger, 1886) the imputation of Heider that his peculiar gastrulas of sponges were merely shriveled blastulæ.

New Fresh-water Cœlenterate.—Dr. Ussow describes (Ann. and Mag. Nat. Hist., xviii, p. 110, pl. iv, 1886) a new fresh-water Cœlenterate from the rivers of Russia. It is a Hydromedusa, but differs so from all others that it is made the type of a new genus, Polypodium. The young stages are remarkable in that they are passed as parasites in the eggs of the sterlet, about one-fifth of the eggs being thus infected. This stage is described as a cylindrical spiral twisted tube with numerous lateral buds. This feeds upon the yolk granules which are taken up by the *ectodermal* cells and are thence passed to the endodermal ones. From this is developed the free stage, which is more like a normal Hydromedusa and is provided with six, twelve or twenty-four tentacles, but lacks an umbrella. The perfect or sexual stage is not known. A full paper is promised soon.

Nervous System of the Sea-urchin.—M. H. Pronho states that if one suitably treats a portion of the integument which covers the test of *Echinus acutus* with chloride of gold or citric acid, numerous bluish lines connected by frequent anastomoses will become apparent; the appearance forcibly recalls that figured by Professor Loven of the peripheral nervous system of *Brissopsis lyrifera*. Examined under a power of 500, the plexus will be found to consist of a large number of fibrils, and some of the principal bundles will be seen passing towards the spines and adjacent pedicellariæ. The fibrils of which this plexus is formed are identical with those of the tentacular and ambulacral nerves, and each is continuous with the fiber from the ambulacral nerve which emerges from one of the tentacular pores; the plexus lies between the external epithelium and a layer of connective tissue which sends off a number of connective bands through the meshes of the nervous plexus to support the epithelium. At the base of each spine there is a relatively well-developed nervous ring. The cellular elements of the plexus are very difficult to detect in the plexus, but they are very numerous and easy to see in the nerve-ring; the author does not, however, agree with M. Romanes in his description of these elements. M. Pronho has also been able to make out a nervous genital ring, which connects the five genital glands with one another and, by means of the five ambulacral trunks, with the peribuccal nervous pentagon.—*Comptes Rendus, cii (1886), pp. 444–6.*

The Crustacean Carapax.—There seems to be a certain fatality connected with some scientific facts. Away back in 1834 the late Henri Milne-Edwards had a conception of the true morphology of the crustacean carapax, and eighteen years later James D. Dana still further elaborated the matter. But, notwithstanding the weight of their authority, their views failed to gain general acceptance and almost every text-book[1] to-day states that the

[1] Dana's view was adopted by Packard twenty years ago, and is taught in his text-books and lectures.

carapax of crabs and lobsters represents the coalesced terga of all the cephalic and thoracic segments, and a line crossing it is pointed out as the suture dividing the head from the thorax—the cervical suture. This view is wholly erroneous and has arisen from an attempt to trace homologies where none exist. Dr. Howard Ayers (Bulletin Essex Institute, Vol XVII, pp. 49–59, pls. II–III, 1886) has recently restated the problem and the evidence to show that the carapax is in reality to be regarded as the coalesced terga of the antennal and mandibulary segments, and that the "cervical suture" merely indicates the line between them. His presentation of the case should be conclusive. He further shows that the parts regarded by Milne-Edwards as episterna are in reality portions of the sternum cut off by the appearance of false sutures.

Development of Phyllopods.—Claus, in the last Heft of the sixth volume of the Arbeiten zool. Inst., Wien, gives an account, illustrated with twelve plates, of the structure and development of the Phyllopod genera Branchipus and Artemia, which supplements his former paper published in Göttingen, 1873. He discusses the segmentation and development of the body during metamorphosis, the segmentation of the mesoderm and the differentiation of the ectodermal and mesodermal organs, the formation of regions and the number of segments, integument, connective tissue and fat bodies, muscles, nervous system and sense organs (including the median and lateral eyes), the alimentary and excretory organs, heart, circulation and respiration, and the sexual organs, thus giving a monographic treatment of the development of the group.

The Ribs of Sphenodon (Hatteria).—Cope[1] has shown that in some of the Pelycosauria the capitulum of the two-headed ribs is attached to the intercentrum.

The question arose immediately: Is it not probable that the living Sphenodon with so many characters common to the Permian Pelycosauria shows the same condition?

The ribs of Sphenodon are described by Owen, Günther and Albrecht. None of these authors speak about ribs connected with the intercentrum (hypapophysis), but they have observed two-headed ribs in the cervicals.

Owen[2] says: "The fourth vertebra has a short pleurapophysis on each side with a bifurcate proximal end articulated by a broad tubercle to the diapophysis and by a slender neck and head to a

[1] Cope, E. D. Description of Extinct Batrachia and Reptilia from the Permian formations of Texas. Palæontol. Bull. No. 29, p. 518. Amer. Philos. Soc., April 5, 1878.

The Relations between the Theromorphous Reptiles and the Monotreme Mammalia. Proc. Amer. Assoc. Advanc., Sc., Vol. XXXIII, Philadelphia meeting, September, 1884.

[2] Descriptive Catalogue of the Osteological Series contained in the Museum of the Royal College of Surgeons of England. Vol. I. London, 1853, p. 142.

rudimental parapophysis, but this is very feebly marked off from the diapophysis. In the fifth vertebra the parapophysis and diapophysis form together an oblique ridge, chiefly extended vertically, and to which the expanded head of the pleurapophysis articulates by a single surface."

Günther[1] says: "In one example the pleurapophysis of the fourth vertebra is not bifurcate, the lower branch being replaced by a ligament, and no trace of a parapophysis can be distinguished."

Albrecht[2] says: "Quatrième vertèbre cervicale.—Diapophyses bien développées et séparées par une échancrure d'un rudiment de parapophyse. Tubérosité de la côte également bien développée et séparée aussi par une échancrure du col de la 4^e côte cervicale. La diapophyse articule avec la tubérosité de la dite côte, tandis que le rudiment de parapophyse est réuni par un ligament au col. Nous avons donc ici une combinaison des cas de Owen et de Günther."

According to all these authors the first rib appears on the fourth vertebra.

My own examinations made on two alcoholic specimens of Sphenodon, show the following:

First vertebra (atlas). — Single headed *ligamentous* ribs connected with the distal part of first intercentrum (between occipital condyle and atlas).

Second vertebra (axis). — Two-headed *ligamentous* ribs. Capitulum connected with distal part of second intercentrum (between atlas and axis); tuberculum connected with a small diapophysis of the vertebra.

Third vertebra.—First specimen, two-headed *ligamentous* ribs; second specimen, two-headed osseous ribs. Capitulum ligamentous connected with small process (parapophysis) on the posterior lateral part of third intercentrum, tuberculum connected with diapophysis.

Fourth vertebra.—Two-headed osseous ribs. Capitulum well developed but not entirely ossified, the proximal *ligamentous* part connected with the process (parapophysis) of fourth intercentrum, tuberculum attached to the well-developed diapophysis.

Fifth vertebra.—One-headed osseous ribs. Capitular part *rudimentary* and *ligamentous*, connected with fifth intercentrum, tuberculum well developed, attached to a short but broad diapophysis.

All the other cervical and dorsal vertebræ show the same condition as the fifth cervical.

Albrecht[3] believes that the diapophysis of the fifth and the

[1] Günther, A. Contribution to the Anatomy of Hatteria (Rhynchocephalus Owen). Philos. Trans., Part I, for 1867, p. 11.

[2] Albrecht, P. Note sur la présence d'un rudiment de Proatlas sur un exemplaire de *Hatteria punctata* Gray. Bull. Mus. Roy. d'Hist. Nat. Belg., Tome I, 1883, pp. 190–191.

[3] Albrecht, loc. cit., p. 190.

following vertebræ represents a *paradiapophysis* and the head of the rib a *capitulo-tuberculum*. I believe that the diapophysis consists of *diapophysis* only, and that the head of the rib represents only the tuberculum,[1] the capitulum being distinct but ligamentous.

The living Sphenodon shows therefore in principle the same condition of the rib-articulation as the Permian Pelycosauria. But there are still other Sauropsida which have some of the ribs connected with the *intercentrum*. In all Crocodilia and Dinosauria the first rib of the atlas is attached to the *intercentrum* between the occipital condyle and the atlas. The same condition can be found in birds, where this first rib has become ligamentous, and probably in all Sauropsida with ribs connected with the Atlas.

I do not doubt that the Ornithosauria show the same condition, since L. v. Ammon[2] has shown that the cervical ribs of Rhamphorhynchus are like those of the crocodile.—*Dr. G. Baur, Yale College Museum, New Haven, Ct., Sept. 19, 1886.*

Birds killed by electric light towers at Decatur, Ill.—I enclose a slip cut from the Decatur Republican of last evening; also a list of birds brought to me yesterday by boys from different parts of the city, as determined by Professor J. H. Coonradt of our High school. Some of them are seldom seen in this neighborhood, so far as my observation goes. Indeed, most of them are rarely noticed in the city this time of the year. I think none were found under the lamps this morning. From the numbers I saw and heard of yesterday I should think it probable that a thousand birds were killed around the electric light towers which light our town. I suppose this is not an unusual occurrence, but as the numbers were so great I thought possibly you would like to make a note of it.

Following is the list of the birds killed by the electric light towers: Redstart (*Setophaga ruticilla*), red-breasted grosbeak (*Goniaphea ludoviciana*), indigo bird (*Cyanospiza cyanea*), black and yellow warbler (*Dendrœca maculosa*), house-wren (*Troglodytes ædon*), Maryland yellow-throat (*Geothlypis trichas*), Acadian flycatcher (*Empidonax acadicus*), scarlet tanager (*Pyranga rubra*) cat-bird (*Galeoscoptes carolinensis*). olive-backed thrush (*Turdus swainsoni*).—*E. A. Gastman, Decatur, Ill., Sept. 29, 1886.*

Zoological News.—*General.*—M. Zarondnoi (Bull. Mosc. Soc. Nat.) enumerates 184 species of birds in the Trans-Caspian fauna. He divides the district into three sub-regions, (1) the Kara-Kum desert, (2) the Akhal-Tekke oasis, (3) the mountains. The first district has a pretty well furnished flora, spite of its immense

[1] The same condition exists in the Lacertilia, Pythonomorpha, and Ophidia.

[2] Ammon L. v. Ueber das in der Sammlung des Regensburger naturwissenschaftlichen Vereins aufbewahrte Skelett einer langschwaenzigen Flugeidechse Rhamphorhynchus longicaudatus, Correspondenzblatt des naturwissenschaftlich. Vereins in Regensburg, 38 Jahrgang, 1884, p. 155.

sandy plain and salt clays. The reptiles of this sub-region, which extends into the Akhal-Tekke oasis, are, of lizards, two species of Phrynocephalus, *Agama sanguinolenta* and *Varanus scincus;* a Testudo, and the snake *Naja oxiana.* This oasis has a most monotonous landscape, but is pretty well furnished with insects, among them Julodis (3 sp.) several kinds of Ateuchus and Copris, and numerous Melanosomata. Jackals, and on the banks of the few rivers the wild cat and the Lagomys occur. The summer in this oasis is very hot; 40 Celsius in the shade is not uncommon. The summer molting of the birds is by our author attributed to this great heat. The lark has parts of its body quite bare at that season. The bulk of the birds of the oasis during the summer belong to the Aral-Caspian fauna, but others come from the mountains, following the rivers. Griffons, ravens, swifts and swallows live in the mountains, but descend to the plain to hunt. In the valleys of the mountains the leopard and the cheetah are rare, *Hyæna striata* is occasional, and *Ellobius talpinus*, several species of Erinaceus and Platycercomys and *Hystrix hirsutirostris* are common. The dreadful *Vipera eufratica* is a source of continual danger during the grape harvest of the forested upper valleys.

Protozoa.—Gruber has been studying the phenomena of conjugation as presented by Paramecium, and states that not only is there a union of the nuclei, but that the nucleoli "come into intimate contact, copulate with each other." He claims that the act has not only a sexual function but it plays a part in rejuvenescence, and that there is an exchange of protoplasm between the nucleoli.

Rhizopoda.—Mr. Whitelegge enumerates twenty-four species of Rhizopoda in New South Wales, mostly identical with those found in Europe, America and India. The list includes *Pelomyxa palustris*, *Rhaphidiophrys elegans*, *Clathrulina elegans*, and *Biomyxa vagans.*

Cælenterates.—Mr. G. H. Fowler (Quart. Jour. Mic. Soc.) describes the anatomy of two species of madrepores. *M. durvillei*, has four features in common with the Alcyonaria: (1) a tendency to absence of polyps on the ventral side of the branches; (2) the very definite orientation of the polyps; (3) the differentiation of the mesenteries; (4) the distinct dimorphism.——Nothing has hitherto been known of the development of the Cubomedusæ. Haacke publishes in the Zool. Anzeiger (IX, p. 554) some notes on the development of an Australian Charybdea in which he shows that Haeckel was probably correct in his supposition that there was an alternation of generations in these forms. He also gives notes upon the development of the sense organs and phacellæ and states that the velar canals are at first unbranched. The umbrella at first is pyramidal, much like that of the Scyphostoma forms, and only later does it attain the cubical form characteristic of the adult.——W. L. Sclater describes (Proc. Zool. Soc., 1886) a fifth species of deep-sea coral of the genus Stephanotrochus. It comes from the British seas and was dredged at a depth of 570 fathoms. Some notes are given of its anatomy.

Vermes.—Mr. W. B. Benham (Quart. Jour. Mic. Soc.) first gives a condensed historical review of the various works on earthworms, and a chronological record of the discovery of new facts; then briefly enumerates and describes all known earthworms; then takes the various organs in order, and points out their variations, and lastly describes some new species. Among these is *Microchæta rappi* from South Africa, a worm three feet six inches long, and therefore comparable with Antæus and Titanus from South America. Another species of Microchæta from Natal follows, and is succeeded by Urobenus (1 sp.), Diachæta (1 sp.), and Trigaster (1 sp.) all new genera.——Mr. Weldon contributes to the same journal an account of *Dinophilus gigas*, found at Penzance, England. Three species of the genus were previously known. Dinophilus is stated on the one hand to be related to the Archannelids, while on the other it retains many features characteristic of the common ancestor of these groups, in which Mr. Weldon includes Crustacea, Mollusca and Rotifera, as well as Chætopoda and Gephyrea. The relations of the body cavity, excretory system and pharynx point to a Turbellarian origin.——The tapeworm, *Tænia filicollis*, has been known as a parasite of the sticklebacks (Gasterosteus). Dr. Leidy now reports it from specimens of Amia from North Carolina, though there is some doubt as to whether it was really parasitic in these fishes.——E. A. Rau reports four cases of trichinosis at Bethlehem, Pa., in the early part of the present year, two of which resulted fatally. All were caused by eating from the same infected pork.——Kennel, in the last "Heft" of "Semper's Arbeiten," completes his account of the development of Peripatus. He differs greatly on many points from Sedgwick's account of the embryology of the species of the same genus from the Cape of Good Hope.

Arthropoda.—J. J. Quelch has announced (Nature, July 29, 1886) that a Peripatus, apparently *P. edwardsii*, is found in the Demerara division of British Guiana. An example which, when not elongated, is about three and a half inches long, has thirty-one pairs of feet, the last three of which it rarely puts to the ground except when it goes backward. It frequently discharges a viscid secretion when handled. Mr. Im Thurm previously found small specimens in Essequibo.——According to observations made by M. G. St. Remy upon the brains of *Scolopendra morsitans* and some other myriapods, the Myriapod brain is simple and approaches that of Crustacea.——M. Trouessart (Comptes Rendus, July, 1866) notes the presence, within the upper part of the shaft of the feathers of a curlew shot in the winter, of several Mallophaga of the genus Colpocephalum. The hole by which these insects entered was placed upon the lower side of the feather, in the furrow, about two centimeters from the upper umbilicus. The insects were dead, and were accompanied by the empty shells of the eggs they had laid, with a few ova which still contained embryos. A hole about five millimeters from the lower umbilicus was apparently the outlet of the larvæ. The interior of the soft portion of the feather had been devoured. It is not yet ascertained what conditions determine these devourers of feathers to seek refuge within the quill. Acaridæ, Syringophilus and other genera have before been found within the shaft, but these seem to enter by the upper umbilicus.——Houssay has been studying the arterial system of the scorpion (Comptes Rendus, Aug. 2, 1886, p. 354). The greatest interest centers in his description of the sternal artery which ensheathes the nervous cord almost exactly as it does in Limulus, thus affording additional evidence in favor of the view held by Van Beneden, Lankester and Kingsley, that the king crab is closely related to the spiders.——Winckler having recently announced that he had found a heart in the Gamasid mites, and that it could be studied through the transparent integument of the living animal; Kramer calls attention to the fact that he announced the same in the Archiv. für Naturgeschichte for 1876.——Brady gives a list (Proc. Zool. Soc., 1886) of all the known Entomostraca of South Australia, and adds several new species to the number.——Beddard, in the same journal, completes his preliminary account of the *Challenger* Isopoda.——Frenzel thinks the "Mitteldarmdruse" (the so-called liver) of the Crustacea has the function of a digestive gland which shows in its physiological action, great similarity to the pancreas of the Vertebrata.——Another "fossil myriapod" must go, it having been discovered that "Trichiulus" was based upon a fern.

Mollusca.—M. Th. Barrois gives in his thesis before the Faculty of Sciences of Paris an account of the foot-glands and aquiferous pores of the lamellibranchs. There is great variety in the byssus-forming apparatus, but *Cardium edule* furnishes a good typical example. The byssus is a glandular product, and does not consist of dried or chitinized muscular fibers. *C. edule* has a simple byssus of one filament, while Lima, Pinna, and Avicula have many. In Arca the filaments are united into a mass, and Anomia has a similar mass which is encrusted with calcareous salts, so as to appear as an ossicle. M. Barrois describes the muscles of the byssus; the cavity of the byssus, which receives the secretion; the glands of the cavity; the byssal canal; the groove, and the glands of the groove. In some species every vestige of the byssal apparatus has disappeared (*Solen ensis*, etc.), while other forms show a partial disappearance. The mucous glands are sometimes scattered over the foot, but more often they are localized in the free anterior extremity; while in Lima, Pecten, and Anomia they discharge into a furrow. It has often been argued that the rapid increase and diminution of size observable in the foot must be caused by the presence of aquiferous pores which permit water to enter into the circulation, but M. Barrois has searched in vain for such pores.——M. Giard has discovered a new species of Entoniscus (*E. mœnadis*) upon a female *Carcinus mœnas* obtained at Wimereux. It was situated upon the left side of the animal, in the midst of the hepatic cæca.——The question why the scallop, Pecten, is so abundantly supplied with eyes has often been asked and has never received a satisfactory answer. Dr. Benjamin Sharp now states that these organs are really phosphorescent and that as the production of light would be of advantage to the animal this may possibly explain their abundance.——W. D. Hartman adds new difficulties for the students of conchology by describing several more "species" of the much-abused genus Partula of the South Seas. There is now not much choice between Partula or Achatina and our own Unio.——Heilprin reports a remarkable instance of vitality in a marine mollusk. Specimens of *Ilyanassa obsoleta* lived for a year removed from salt-water, and for several months of this time they were placed in close proximity to a heated wall where certainly the conditions were not favorable for them.

Fishes.—Dr. Paul Albrecht, formerly of Brussels but now of Hamburg, notes the occurrence, in an example of *Protopterus annectens* in the Konigsberg Museum, of a pectoral member (the right), which is forked at the distal extremity. Above this divided fin are two small outer gills, while there is but one above the left pectoral. Dr. Albrecht considers the dorsal division as the ulna, the ventral as the radius.——H. H. Giglioli sends to Nature an account of the capture of a specimen of *Mullus barbatus* which by some means had become tightly encased in a large colony of *Pyrosoma atlanticum*. The head of the fish had reached the bottom of the social cylinder, and only about a fourth of its length projected posteriorly. It was taken alive.

Reptiles.—Messrs. Mitsukuri and Ishikawa (Quart. Jour. Mic. Soc.) report as a general result of their studies of the formation of the germinal layers in the Chelonia, that the development of the Reptilia harmonizes completely with that of Batrachia.

Birds.—Some remarkable birds of paradise have been recently described by Dr. Finsch and Dr. Meyer (Zeitsch. Ges. Orn. II, pp. 369–391). Among them is *Paradisornis rudolphi* with blue wings and blue flank-plumes. These novelties were discovered by Mr. Hunstein in the Astrolabe range of New Zealand. Mr. Forbes has since collected most of Mr. Hunstein's species, and also a Melithreptes and a Pseudogerygone which seem to be new. Mr. Forbes' birds of paradise, gathered in the rainy season, show the molts and changes of plumage of these birds.——M. M. Charbonnel-Salle and Phisalix have studied the so-called "milk" with which pigeons feed their young and find that it is not a glandular secretion (as is the material with which the Callocalia constructs its edible nests), but is a formation of modified epithelial cells. This material is produced in the œsophagus of both the male and the female parents until about the twentieth day after the eggs have hatched.

EMBRYOLOGY.[1]

WHY DO CERTAIN FISH OVA FLOAT?—In a recent paper, by a Mr. Prince (Ann. and Mag. Nat. History, 1886), his readers are informed that the buoyancy of certain fish ova is not due to the presence of drops of oil in the yolk as supposed by Ryder, or words to that effect. Had my conclusions not been so summarily disposed of by one whose information is clearly not very accurate or extensive, the writer would not trouble himself to reconsider the subject of the buoyancy of fish ova. In my Embryography of Osseous Fishes (p. 118), I have stated that "the buoyancy of the cod's egg is undoubtedly due to the diminished specific gravity of the protoplasmic matter of the vitellus, and not to the presence of any oils. In this respect it represents an unique type of the buoyant ovum." This statement, published in 1884, but written in 1882, is essentially the same as that of Mr. Prince, published in 1886. Comment is unnecessary.

There are several types of buoyant ova. These are: (1) Those in which the specific gravity of the yolk is diminished, as in the egg of the cod; (2) those in which large oil-drops in an eccentric position aid in causing the eggs to float; (3) those in which a very large oil-drop caused the ovum to float even in fresh water.

These three categories are also, in all probability, connected by intermediate kinds; that is, amongst forms of the second series there are some which are buoyant in water with as low a specific gravity as 1.014, while others are not buoyant in water of less specific gravity than 1.025, while those in which the proportion of oil to plasma is very great, or about as 1 to 7, are buoyant in water with a specific gravity of very nearly 1.000, or in that which is fresh.

As a rule, the buoyant ovum has the oil gathered into a single drop embedded in the vitellus nearly opposite the germinal disk; there seem to be few exceptions to this rule. There are also but very few species known which have buoyant ova without an oil drop, and these are buoyant only in water of rather high specific gravity. Furthermore, as a rule, fish ova which are buoyant are not adhesive, but float about near the surface singly; the most noteworthy exception to this rule is presented by the great pelagic egg-ribbons of Lophius.

[1] Edited by JOHN A. RYDER, Biological Department, Univ. of Penna., Philadelphia, Pa.

The great majority of species of both fresh and salt water fishes, which have heavy, subsident ova containing oil, have their eggs provided with thick, heavy membranes, which are adherent to each other or to foreign bodies, or to both. Furthermore, their egg-membranes are usually adhesive, with the oil-drops scattered beneath the surface of the vitellus, or aggregated in a flat, discoidal group beneath or alongside of the germinal disk, and not very transparent. The whole egg is also usually more or less colored or granular. The egg-membranes of those species which have buoyant ova are, on the other hand, characteristically thin and delicate, so that it is difficult, if not impossible, to make out the presence of pore canals, while the whole egg is, as a rule, remarkably transparent.

These characteristics seem to show that the buoyant ovum is a very well-defined and specialized type, which has been developed in the course of the struggle for existence to serve a very useful purpose in insuring the protection and survival of the embryo during the hatching period.

There are fresh-water forms, also, which have buoyant ova, as in the case of *Macropodus venustus*, in which the proportional volume of the oil-drop is greater than in any other known type. The oil in this case when liberated at once floats at the surface, as does the egg when entire, while the plasma of the germ and vitellus at once sinks. This fact, it seems to me, finally and conclusively proves that the pelagic or buoyant habit of many fish ova is due to the presence of oil aggregated, as a rule, at the vegetative pole of the vitellus in the form of a single drop. The other conditions are (1) that the egg be free and not adhesive, with a thin membrane, and (2) that it be immersed in water having a greater density than 1.014. The one notable exception to the last part of this general statement, viz., Macropodus,[1] it seems to me, serves to show that the presence of oil is very important, and may exceptionally be the sole cause of the buoyancy of the egg.—*John A. Ryder.*

THE ORIGIN OF THE PIGMENT-CELLS WHICH INVEST THE OIL-DROP IN PELAGIC FISH EMBRYOS.—During the past summer, in observing the development of the common mackerel, *Scomber scomber*, I noticed that pigment cells began to appear on the innermost side of the oil-drop before the tail of the embryo had become prominent. Noting the condition of the oil-drop, and its relation to the surrounding structure, it was noticed that a thick layer of protoplasm invested it. This investing layer of protoplasm, it was also observed, was absolutely continuous, with the layer of periblast enveloping the yolk. Consequently, the only source from whence the nuclei of the pigment cell surrounding

[1] For an opportunity to study the development of this form, I am indebted to my friend Wm. P. Seal.

the oil-drop could have been derived was the periblast. That layer being hypoblastic, so far as its morphological relations are concerned, it follows that the pigment cells which are developed around the oil-drop in Scomber, Scomberomorus, Chætodipterus, etc., arise from the hypoblast.—*John A. Ryder.*

Life History of Thalassema.[1]—This very useful memoir deals with a type, the phyletic history of which is very obscure. The author concludes that Thalassema is an Annelid in which simultaneously with the lengthening of the alimentary canal, there has been a suppression of metameric segmentation. The ova are developed from free plastids, which become detached from the peritoneum, and float about in the perivisceral fluid, in which they grow to maturity. The eggs when discharged are buoyant; undergo a total and equal segmentation, accompanied by the expulsion of two polar globules; the first one of these finally undergoing subdivision into two. An invaginate gastrula is formed, which elongates as the stomach is formed; the latter is then subdivided by three constrictions, bends upon itself, and finally unites with the body-wall, and the anus breaks through at a point corresponding to one end of the blastopore, which has, in the meantime, become elongated. The embryo, at first covered by cilia, finally developes preoral, postoral and perianal ciliary girdles, and thus becomes a trochosphere. The ectoderm opposite the gastrula mouth becomes thickened to form the beginning of the nervous system, the second part of which is developed later as a ventral ectodermal thickening, occupying the position of the closed lips of the lengthened blastopore. The muscular system arises from two mesodermal bands near the anus, which grow forward and become segmented. In the course of further growth the segmentation disappears, the preoral lobe becomes filled with muscular tissue, the setæ appear as mesodermal organs, the anal pouches arise as ectodermal invaginations, and finally admit, through their internal openings, a large quantity of water into the body cavity, which causes the animal to increase much in size.

The larva finally finds its permanent home in some cavity in a sand-dollar shell. Here, by means of its preoral lobe, which has now become long, flexible and muscular, and by the aid of secretions from dermal glands, it arranges for itself rough chambers in the sand with which the shell is filled. In this chamber it remains a prisoner. Here it grows to maturity, completely secure from external attack. Its only means of communication with the exterior is through the small oral opening of the sand-dollar shell, and through this it must obtain all its food and cast its sexual products when mature.

The speculations of the author as to the origin of irregular seg-

[1] H. W. Conn. Studies from the Biolog. Lab. Johns Hopkins University, III, No, 7, pp. 351–401, pls. XX–XXIII, 1886.

mentation (on page 370 and *infra*) do not seem to the reviewer to be borne out by the facts. On page 373 he says: "The object of food-yolk, as is well known, is to enable the young to abbreviate its development by having its food supplied, and being consequently able to skip some of its ancestral stages." Instead of this being the fact, exactly the reverse is true, as has been shown by Balfour, Cunningham and myself.—*John A. Ryder.*

PHYSIOLOGY.

Some Notes on Recalcification of Human Teeth.[1]—The extent to which human development depends upon the proper utilization of food is such that any fact bearing upon the success of this process becomes of paramount importance.

Living in a section of country where diet and drink are unusually deficient in calcific elements, my attention was many years ago called to the analogous condition of the teeth of children in that region, which, as a rule, are characterized by a corresponding deficiency in calcific elements.

Rapid and remarkable changes also occur in the condition of the teeth of adults—almost in direct ratio to their changes of environment in this respect. The "baker's bread" and other food products in most general use by the inhabitants of the region near the Gulf of Mexico, and more especially by the inhabitants of cities, are largely divested of calcific elements, while the water used for potable purposes is almost exclusively rain water, which, though a good solvent, contains no mineral elements.

The wonderful power of adaptation possessed by our race is such that people, living in this region for a number of generations, acquire the power of appropriating, from the meager supply thus furnished, the necessary elements to produce fairly good teeth; but the very large number of residents, not natives of this section, whose early life and the life of their ancestors, has been spent in regions where calcific elements were more abundant, and whose constitutional habit was accustomed to that abundance, are not able to assimilate, out of this meager supply, the requisite proportion of limesalts.

The function of nutrition being dual in its character—removing effete and worn-out material on the one hand, while supplying the elements to maintain the integrity of the tissues on the other—the calcific elements, which form the inorganic basis of tooth-substance, and which rendered the teeth hard and firm, are carried away, while the supply to rebuild, being deficient in quantity, the corresponding amount is not restored, the teeth in consequence soon become decalcified and softened, falling an easy prey to unfavorable conditions.

[1] Read before Sections F and H in joint session, Buffalo Meeting A. A. A. S., August, 1886.

The fact of decalcification has long been recognized in the proverb concerning mothers: "For every child a tooth," not, however, that the material of the mother's tooth is absolutely taken away to build up those of the child, as was once taught, but that the increased demand for building material not being met with increased supplies sufficient to meet the demands of both mother and child, the teeth of the former suffer the consequences of lack of supplies.

The rapid decalcification thus occurring, is not a breaking down of the organic structure, and, if the material necessary to recalcify, is provided in a form which nature can appropriate, this softening may be prevented, or teeth which are already softened may be rendered hard and durable.

Observing these phenomena—this softening of teeth in persons coming from regions where good teeth are the rule, and the recalcification following their return to their old homes—led me to investigate the relations between environment and the development of teeth.

A careful observation of these phenomena not only showed the utter fallacy of the old *dictum*, that the teeth were subject to no changes after maturity, but also showed that there must be a system of circulation throughout the entire substance of the tooth, making this action of the nutrient function possible during the whole life of the tooth.

The fact of decalcification and recalcification, and continued nutrient action during life, being established by long observation, suggested the study of the best modes or methods of aiding nature in the work of recalcification.

Any possible change from ordinary diet, was found, as a rule, entirely inadequate; the natural suggestion of the direct administration of the phosphates—the chief inorganic elements in tooth substance—also proved entirely unsatisfactory, and led to the recognition of the truth that "nature will not take the elements from any ready-made source, but must elaborate her own pabulum."

Noting that the recalcification observed in the teeth of those visiting favorable regions was *not* due to the use of lime in the shape of phosphates, and that the difference between the nutrient elements of these same people, whether in the mountains or in the lowlands, lay more largely in the water they drank than in the food they ate, suggested the administration of aqua calcis; and this was followed by results as eminently gratifying as the use of the phosphates had proved unsatisfactory.

A new preparation of lime, in the form of a syrup of calcis, of much greater strength than the aqua calcis, and proportionately more prompt in its action and effects, has proved still more gratifying in its results.

An extended experience of many years has proved that by this means it is not only possible to *restore* soft, decalcified teeth of all ages, but to *prevent* their decalcification, and also to forestall defective calcification of children's teeth, and even to improve the original type; so that we are now able to overcome not only bad environment but even bad heredity also.

Running *pasi passu* with my study and observations on the investigations of the microscopical histologists, the discoveries of McQuillen, S. P. Cutler, Carl Heitzman, Bodecker, Frank Abbott, A. H. Thompson and others, have demonstrated the existence of the system of nutrition, which, reasoning *a posteriori*, I assumed and announced many years ago.

The living fibrillæ radiating through the dentinal tubuli; the osmotic action between cementum and dentine, and dentine and enamel, and *vice versa*, the circulating currents through the areas of living matter between the enamel rods and prisms are, to-day, admitted histological facts, demonstrated by the microscope.

The tooth is raised to the dignity of a living organ, with a circulating system, carrying pabulum to all its parts to supply the hunger of its needy tissues.

A knowledge of these facts, and of the best methods of supplying material to maintain the integrity of the dental tissues, or of restoring those whose integrity has been impaired, is destined to have a far more important bearing upon human welfare than any degree of skill in operative or prosthetic oral surgery.—*J. R. Walker, D.D.S.*

ANTHROPOLOGY.[1]

FOLK-LORE.—The study of folk-lore may now be said to have passed through the collector stage and to have begun to assume the shape of a science. It was very much so with stone implements. Not many years ago a man who had a large collection of arrow-heads and such things was called an archæologist. But we now call by that name the men who utilize these things to spell out the history of human industry and invention. Folk-lore is to human knowledge, belief, literature, what the stone age is to the iron age. At first a folk-lorist was a man who collected songs, tales, legends, sayings, or who recorded the customs of agraphic peoples; he is now one who arranges these in order to find their law of being.

The folk-lorists of England have been wrestling for the last three years with the following questions:

1. The definition, the inclusions and exclusions of the term *folk-lore*.
2. The establishment of classific concepts for the material included. It is very easy to say, put things together that are alike; but it is most difficult to settle upon that characteristic of likeness which will combine our examples into what may be called natural genera, species etc. Connected with this idea of classific concepts is the associated one of terminology.
4. The anatomy of tales, customs, practices, etc., and the invention of a glossary of their organic parts, their *dramatis personæ*, their essential incidents.

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

In Vol. III of the Folk-lore Journal (pp. 1–16), Mr. G. L. Gomme undertakes to answer these questions. He had previously (in Vol. II, pp. 285, 311) advocated a systematic effort of folk-lorists in the same direction. A few definitions are given below to indicate the mental drift of the gentlemen interested:

"Folk-lore is anthropology dealing with primitive man" (Alfred Nutt).

"Folk-lore is anthropology dealing with the psychological phenomena of uncivilized man (meaning unlettered as well as savage), and embraces both folk-thought and folk-wont (practice)" (E. Sidney Hartland, Folk-l. J., II, 340).

"That portion of anthropology which deals with the psychological phenomena of primitive man" (C. Staniland Wake, Folk-l. J., II, 345).

"Folk-lore is the unwritten learning of the people. Folk-lore is not a science, it is the thing itself. One of the chief objects of the collection and arrangement of the facts of folk-lore is to generalize and philosophize, but the generalizations which we arrive at will not be folk-lore" (Henry B. Wheatley, Folk-l. J., II, 347).

"Folk-lore deals primarily with the survival of primitive customs and beliefs among civilized races, and is comparable with, not identical with, the living primitive customs and beliefs of savage races. The sanction back of folk-lore is tradition. Folk-lore is the science which treats of the survivals of archaic beliefs and customs in modern ages" (G. L. Gomme, l. c. III, 14).

"Folk-lore, 'the folk's learning,' all that the folk believe or practice on the authority of inherited tradition, and not on the authority of written records" (Charlotte S. Burne, Folk-l. J., III, 103.

"Folk-lore is the science which has for its object the study of indifferentiated or anonymous humanity, from an epoch which may be considered its infancy down to our own day" (Antonio Machado y Alvarez, Folk-l. J., III, 113). [This whole essay must be read. One cannot afford to omit a sentence.]

"Folk-lore is knowledge of folk-life, or the life of the uncultured classes, as distinguished from culture-lore, knowledge of individualized life, the life of the cultured classes; and the generalizations arising from these two knowledges, or the sciences of folk-life and of culture-life are complementary and mutually corrective divisions of the same mental and moral sciences, the historical sciences, namely, or mental development and of civil progress" (T. S. Stuart Glennie, Folk-l. J., IV, 75).

We come now to the second series of questions, the subject of classific concepts, the study of "What should go where," as Miss Charlotte S. Burne happily puts it.

Mr. E. Sidney Hartland divides folk-lore into two departments, *folk-thought* and *folk-practice*, or still better *folk-wont*. I like folk-wont better, for the reason that folk-lore does not so much include practice. For instance, I may tell you how an arrow-maker or potter produces his wares, and do it so graphically that a mechanic may counterfeit them. But I have omitted the thousand and one dispensables which the lowly artisan considered indispensable, leaving them for the folk-lorist to glean.

Folk-lore is thus divided:

I. FOLK-THOUGHT.

1. Tales of all kinds, sagas (world-god, hero, elf, ghost-sagas, etc.), nursery tales, drolls, cumulative tales, apologues.
2. Folk-songs; 3. Weather-lore; 4. Proverbs; 5. Local and personal saws and prophecies; 6. Riddles; 7. Folk-speech.

II. FOLK-WONT.

1. Worship, every practice designed to propitiate the powers influencing man's destiny.
2. Folk-law; 3. Folk-leechcraft; 4. Games; 5. Folk-craft.

Mr. Gomme gives the following scheme:

1. *Traditional narratives:*
   (a) Folk-tales.
   (b) Hero-tales.
   (c) Ballads and songs.
   (d) Place legends.
2. *Traditional customs:*
   (a) Local customs.
   (b) Festival customs.
   (c) Ceremonial customs.
   (d) Games.
3. *Superstitions and beliefs:*
   (a) Witchcraft.
   (b) Astrology.
   (c) Superstitions, practices and fancies.
4. *Folk-speech:*
   (a) Popular sayings.
   (b) Popular nomenclature.
   (c) Proverbs.
   (d) Jingle rhymes, riddles, etc.

This is amended by Miss Charlotte S. Burne as follows:

Group 1. *Traditional narratives:*
Class a. Folk-tales.
" b. Hero-tales.
" c. Ballads and songs.
" d. Place legends and traditions.

Group 2. *Superstitions, beliefs and practices:*
Class a. Goblindom.
" b. Witchcraft.
" c. Astrology.
" d. Superstitions connected with material things.

Group 3. *Traditional customs:*
- Class a. Local customs.
- " b. Festival customs.
- " c. Ceremonial customs.
- " d. Games.

Group 4. *Folk-sayings:*
- Class a. Jingles, nursery rhymes, riddles, etc.
- " b. Proverbs.
- " c. Old saws, rhymed and unrhymed.
- " d. Nick-names, place rhymes and sayings, folk-etymology.

Mr. J. S. Stuart Glennie divides the study of man's history into that of folk-life and of culture-life. The classification of folk-lore is identical with the psychological elements of folk-life, corresponding (A) with the most general facts of human consciousness: (1) An external world, (2) other beings, (3) an ancestral world; (B) and with the most general facts of human faculty: (1) Imagination, (2) affection, (3) memory. Corresponding with these facts of consciousness and of faculty, the three psychological elements of folk-life are (1) folk-beliefs, (2) folk-passions, (3) folk-traditions; and the expression of these are to be found in (1) customs, (2) sayings, (3) poesy. Folk-customs, as expressive of folk-life, may be more especially expressive of folk-beliefs, or of folk-passions, or of folk-traditions; and hence folk-customs may be classified as (1) festivals, (2) ceremonies, (3) usages (religious, sexual and social). Folk-sayings may be classified as (1) recipes (magical, medical and technical); (2) saws (proverbs, tests, riddles) (3), forecasts (omens, weather signs and auguries). Folk-poesy may be classified as (1) stories, (2) songs (mythological, affectional and historical), and (3) sagas.

ELEMENTS OF FOLK-LIFE AND SUBJECTS OF FOLK-LORE.

I. Folk-beliefs. II. Folk-passions. III. Folk-traditions.

THE EXPRESSIONS OF FOLK-LIFE AND RECORDS OF FOLK-LORE.

I. *Folk-customs:*		II. *Folk-sayings:*	III. *Folk-poesy:*
1. Festivals.	(1) Religious.	1. Recipes.	1. Stories.
	(2) Sexual.	(1) Magical.	2. Songs.
	(3) Social.	(2) Medical.	(1) Mythological.
2. Ceremonies	(1) Religious.	(3) Technical.	(2) Affectional.
	(2) Sexual.	2. Saws.	(3) Historical.
	(3) Social.	(1) Proverbs.	3. Sagas.
3. Usages.	(1) Religious.	(2) Tests.	Folk-music.
	(2) Sexual.	(3) Riddles.	(1) Meters.
	(3) Social.	3. Forecasts.	(2) Melodies.
		(1) Omens.	(3) Instruments.
		(2) Auguries.	
		(3) Weather-signs.	

We are not prepared to accept Mr. Glennie's dictum that folk-lore is our lore about the folk, for that would really be culture-lore, according to his own definition. Several of the gentlemen have wisely started their study with the two inquiries, who are the folk, and what is lore? Señor Alvarez remarks, "The word *folk*, German *volk*, Latin *vulgus*, Italian *volgo*, Spanish *vulgo*, signifies not the whole of humanity, but a portion of the human race, who possess a series of common signs, and are really anonymous in contradistinction from that other series of men who possess a notable personality." He would include practically all savages and the untutored herd of civilized society.

It is very certain that what constitutes the knowings, the sayings and the ways or wonts of the untutored, the unthinking and the unprogressive among us remind us much of savagery. It is also very certain that each age of the world, each gradus of society resembles the geological ages; that is, each one, in addition to all that it has added of new embraces, includes much of all the antecedent ages, grades or epochs. The folk-lorists are, therefore, altogether scientific in collecting the lore of savages *en masse*, the lore of barbaric and civilized peoples, so far as they are *survivals* of times not their own.

Practically, therefore, what do the folk-lorists wish us to collect? and how shall we name and classify our material after it is gathered? Just at this writing we are inclined to use Miss Burne's modification of Mr. Gomme's scheme.

For the filing of tales the folk-lore society has adopted a scheme, with printed headings, as follows:

1. Generic name of story (not to be filled up).
2. Specific name.
3. Dramatis personæ.
4. Thread of story.
5. Incidental circumstances.
6. Where published.
7. Nature of collection. (1) Original or translation.
   (2) If oral, state narrator's name.
   (3) Other particulars.
8. Special points noted by the editor of the above.

(Signed) ——————.

ARROW RELEASE.—This term applies to the actions of an archer in discharging the arrow from a bow. To this topic Professor E. S. Morse has given more attention than any one else, and has published thereon a monograph in the Bulletin of the Essex Institute (XVII, 1885) on purpose to secure further material for a more extended memoir on the subject. The readers of this journal who have noted the methods of arrow release in any part of the world should send their information to Professor Morse, in Salem.

As an example of diversity in these matters, Professor Morse says: In the English practice the bow must be grasped firmly;

in the Japanese, loosely. In both cases it is held vertically, but in the English method the arrow rests on the left of the bow, while in the Japanese it is placed on the right. The English wristguard is worn on the inner and lower part of the arm; the Japanese need none, as they fling the bow half round at the moment of release. The English archer grasps his bow in the middle; the Japanese near its lower third. In the English method the string is drawn with the tips of the first three fingers; in the Japanese the string is drawn back by the bent thumb.

The methods of release characterized are as follows:

1. *Primary.*—The nock of the arrow is grasped between the end of the straightened thumb and the first and second joints of the bent forefinger. It is practiced by children universally, and by the Ainos, Demeraras, Utes, Navajos, Chippewas, Micmacs, Penobscots.

2. *Secondary.*—The nock of the arrow is grasped with the straightened thumb and bent forefinger, while the ends of the second and third fingers are brought to bear on the string to assist in drawing. It is practiced by Zuñis, Chippewas of Wisconsin, Ottowas.

3. *Tertiary.*—In this release the forefinger, instead of being bent, is nearly straight, with its tip, as well as the tips of the second and third fingers, pressing or pulling on the string, the thumb, as in the primary and secondary release, active in assisting in pinching the arrow and pulling it back. It is practiced by Sioux, Arapahos, Cheyennes, Assiniboins, Comanches, Crows, Blackfeet, Navajos, Siamese, Great Andamanese.

4. *Mediterranean.*—The string is drawn back with the tips of the first, second and third fingers, the balls of the fingers clinging to the string, with the terminal joints of the fingers slightly flexed. The arrow is lightly held between the first and second fingers, the thumb straight and inactive. Practiced by nations around the Mediterranean by modern archers, Flemish (using first and second finger only), Eskimos, Little Andamanese.

5. *Mongolian.*—In this release the string is drawn by the flexed thumb bent over the string, the end of the forefinger assisting in holding the thumb in position. The thumb is protected by a guard of some kind. It is practiced by Manchus, Chinese, Koreans, Japanese, Turks, Persians.

The latter half of Professor Morse's pamphlet is devoted to the examination of ancient monuments, etc., in order to ascertain the methods of release practiced in Assyria, Egypt, Greece and other states. This portion of the paper has yielded to the author results by no means commensurate with his pains, because the ancient sculptors were not aware that their accuracy would be scrutinized thousands of years hence.

THE ORIGIN OF LANGUAGES.—The vice-presidential address of the Hon. Horatio Hale before Section H of the American Association at Buffalo was upon the origin of languages and the antiquity of speaking man. It contains views so original and novel that it is eminently proper to present a condensed scheme of the argument.

1. Among the puzzling questions in anthropology which we are bound to notice are these two: When did linguistic stocks originate? When did man acquire the faculty of speech? It will be seen that the origin of languages and the origin of language are two very different questions.

Mr. Hale, rejecting the old theories which rely upon time, the dispersion of a monosyllabic parent stock, the dispersion of speechless man and the origination of languages in different centers, avers that the origin of linguistic stocks is to be found in what may be called the language-making instincts of very young children. To insure the creation of a speech which shall be the parent of a new linguistic stock, all that is needed is that two or more young children should be placed by themselves in a condition where they will be entirely, or in a large degree, free from the presence and influence of their elders, and that they should continue in this condition long enough to grow up, to form a household, and to have descendants to whom they can communicate their new speech. This theory is elaborated with great care and the multiplicity of stocks in California made by a camping-ground of the argument.

The second part of the argument is also accompanied with the revival of startling doctrines, namely, that while the antiquity of man is incalculable the speaking man is of recent origin, having occupied this planet at most not over ten thousand years. "If we are willing to give the name of man to a half brutish being, incapable of speech, we must allow to this being an existence of vast and as yet undefined duration, shared with the mammoth, the woolly rhinoceros, and other extinct animals. But if we term the beings of that race the precursors of man, and restrict the name of men to the members of the speaking race that followed them, then the first appearance of man, properly so styled, must be dated at about six thousand or ten thousand years ago. And this man who thus appeared was not a being of feeble powers, a dull-witted savage. He possessed and manifested from the first intellectual faculties—intellectual faculties of the highest order—such as none of his descendants have surpassed. His speech, we may be sure, was not a mere mumble of disjointed sounds; it was a full, expressive, well-organized speech, complete in all its parts. The first men spoke because they possessed along with the vocal organs the cerebral faculty of speech; "that faculty was an instinct of the mind, as irresistible as any other instinct."

SCIENTIFIC NEWS.[1]

—The French Association for the Advancement of Science held its session this year at Nancy. Thirty-two savans contributed papers upon engineering and mathematics, forty-four upon physics and chemistry, fifty-eight upon the natural sciences, and fifty-nine on economics, some contributing several papers. The Revue Scientifique (Aug. 14) prints in full the address of the president, M. Friedel, upon the progress of chemistry and mineralogy; that of M. E. Collignon, secretary, upon the history of the association during the year; that of M. A. Volland, mayor of Nancy, and that of M. E. Galante, treasurer, upon the finances of the association. From the first of these discourses it appears that spinel, corundum, and rubies have been manufactured artificially, and that the false rubies are not infrequent in the market. The last meeting, held at Grenoble, received a total of 342 communications, 166 of which were upon the natural sciences. Fourteen members were lost by death during the year, including MM. Bouquet, Bouley, Jamin, Robin and Dechambre. The number of associates is kept up to three thousand eight hundred.

Among the papers read in the natural history section were those of M. Cartailhac, on sepulchres of the stone age, etc.; of M. Chatin, on the flora of Paris and Dauphiné; of F. Lataste, on the dentary system of Hyrax; of Manouvrier, on the delimitation of anthropology; of Mortillet, on criminal anthropology, and of Testut, on "microcéphales." A number of distinguished foreigners were present at the meeting. M. Cartailhac drew attention to the prevalence of burial after decomposition of the soft parts. In the reindeer age this was usual. In Spain the body of the late king lies in "el putrido" until the death of his successor. An interesting discussion on wheat production took place in the agricultural section. The wheat growers of Europe regard with anxiety the increase of the wheat production of Hindostan. Some interesting excursions were taken, one to a spot upon German soil was frustrated by the ignorant fussiness of the local German authorities. The next meeting of the association will be held at Toulouse, that of 1888 at Oran, Algeria.

—The new Gogebic Iron range is located parallel with the shore of Lake Superior and about forty miles distant, equi-exposed in Michigan and Wisconsin. There are two veins running very near to each other that average 25 to 160 feet in width and are of unknown depth. The ore is all within the Bessemer limit, varying about five per cent at the surface but assuming an equality below. The veins head nearly south at an angle of thirty degrees from the perpendicular. The quality averages sixty-seven per cent pure hematite and is soft and crumbling. The opening of the range

[1] Edited by WM. HOSEA BALLOU, 265 Broadway, New York.

has caused an unprecedented migration, 15,000 settlers having located there during fifteen months. The range has been exposed for nearly sixty miles, cropping out on the surface of the mountains and disappearing to 250 feet below in the valleys. The depth of the ore in the valleys is explained by its soft texture, the water having swept it away, after which soil filled in and covered it.

— Messrs. J. B. Lippincott Company have in press a "Manual of North American Birds," by the eminent ornithologist, Professor Robert Ridgway, curator, Department of Birds, Smithsonian Institution, Washington, D. C. The work is to contain some 435 illustrations suitably executed, and will conform to the geographical limits, classification, numeration and nomenclature adopted by the American Ornithological Union. We doubt not it will be one of the most important, thorough and original contributions to the literature of the subject which has ever appeared, and presume that naturalists and sportsmen alike will find in it an invaluable aid.

— The output of the iron ore mines of the Lake Superior region will be about 3,000 000 tons for the season of 1886, or one-third larger than in any other past year.

——:o:——

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Philosophical Society, Dec. 18, 1885.—Professor Cope presented for the Transactions "A Chemical Study of *Yucca angustifolia*" by Miss H. C. de S. Abbott.

Jan. 1, 1886.—Professor Allen made a communication on the result of experiments on electric light used in photographing animals in motion.

Professor Cope presented a paper on the Intercentrum of the Terrestrial Vertebrata; also another by Dr. Alfredo Dugés, of Guanajuato, entitled "Sur le *Rhinocheilus antonii.*

Jan. 15.—Mr. Lesley read a paper on the evident Bedouin origin of the *Shedi* deity in the Hebrew Scriptures, commonly translated "the Almighty." He drew the conclusion that it bore a manifest relationship to the deity *Seti* introduced into Egypt and Palestine from Arabia.

Mr. Lesley also communicated a revision of the section of the Le Roy (Chemung) beds in Bradford county, giving additions to the list of its fossils, and extending it downward nearly 350 feet, to include a rich horizon.

Mr. Ashburner made a communication showing the course of the barometer during the storm of Jan. 8th.

Dr. Persifor Frazer spoke upon the application of composite photography to handwriting.

Dr. H. Allen exhibited an example of *Chlamydophorus truncatus.*

Feb. 5.—Professor Cope presented a paper on the structure and affinities of Amphiuma.

A paper from Dr. Hoffman on Indian tribal names, and another, by Professor A. S. Packard, on the discovery of thoracic feet in a carboniferous Phyllocarida, were presented for publication.

Dr. Horn exhibited sketches and anatomical details of Chrysobothris.

Feb. 19.—A paper from Professor S. C. Branner, entitled "The glaciation of the Wyoming and Lackawanna valleys," was presented.

Professor Cope presented a paper on two new species of three-toed horses from the Upper Miocene, with notes on the fauna of the Ticholeptus beds.

March 19.—Dr. Brinton presented two papers by Dr. W. S. Hoffman, one on the Selish language, and another on the Waitshumni dialect.

Dr. Horn explained the process among the Piutes of sweetening acorn meal by percolation with water, so as to render the product edible.

Lieut. Wyckoff made a verbal communication on the action of heavy vegetable or fish oils in reducing heavy combing waves to long swells.

PHILADELPHIA ACADEMY OF NATURAL SCIENCES, July 1, 1886.—Dr. Horn exhibited a pair of a species of beetle the female of which had before been unknown. The female never passed the larval condition, and had been described as the larva of an insect of another family. It is among Coleoptera the only known case of a fertile larval female. The female grub is two inches long, and its segments emit a green phosphorescence along their margins. The specimen had been sent from S. Carolina. An allied form occurs in California.

Dr. Leidy described a number of parasitic worms from the rabbit, meadow-lark, etc., etc.

Dr. G. A. Kœnig placed on record the identification of Stromeyerite from Zacatecas. The Mexicans call it "plata azul." It consists of one molecule of sulphide of silver to one of sulphide of copper. Quartz is the usual gangue of this mineral.

Aug. 5.—Dr. Horn showed a fragment of the palm *Washingtonia filifera* containing a larva of a beetle (Dinapate) recently described by him.

Mr. L. Woolman recorded the discovery by him of a belt of Oriskany sandstone near Pennsville, Lycoming county, Pa. This belt is unmarked in the surveys. The stone was used for building, and contained *Spirifer arenoides*, *S. arrectus* and *Rensellaria ovoides*.

J. C. Arthur, of Geneva, New York, presented a paper on the history and biology of the pear blight.

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DEVOTED TO THE NATURAL SCIENCES IN THEIR WIDEST SENSE.

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McCALLA & STAVELY.

PECULIARITIES IN THE MANUFACTURE OF JENSEN'S CRYSTAL PEPSIN:

NATURE OF THE IMITATIONS, ETC.

THE champion pepsin of the world! The only pepsin found worthy to be imitated! Even the wealthiest manufacturing chemists could not resist the temptation!

One party used glue as a cheapening adulterant for the production of scale pepsin; another party has now succeeded in flooding the market with their imitations of my scale pepsin, owing to its extreme cheapness. This party now declares (not to the profession) that they use sixty pounds of dry egg albumen, peptonized by two hundred hogs' stomachs. A third party wrap their imitations in an exact *fac simile* of my circular, making full use of my testimonials. The great injury these imitations cause my preparations can easily be understood.

The protection chiefly relied upon is through the profession's vigilance in discriminating between the genuine and the spurious article. When prescribing my pepsin, most physicians now underline my name thus, JENSEN'S Crystal Pepsin, and no misconception can excuse substitutions. The great reputation of this pepsin lies in that it is a peptone pepsin, *i. e.*, the texture of the stomachs in which the ferment is lodged is entirely dissolved, thereby obtaining all the pepsin. When thereto is added my recent improvement in precipitating from this solution all of the earthy and saline matter, leaving only the azotized constituent, containing all of the peptic principle, and finally, is further concentrated by drying it upon glass plates until brittle scales are formed, the reason for its high digestive power can easily be understood. Why it surpasses also in keeping qualities all of the former pepsins, is owing to its scaly and brittle texture, it being the only organic medicine in the materia medica produced for the market in scales.

It is also perfectly soluble upon the tongue, pleasant to the taste, and practically inodorous.

Although it commands a higher price than any other pepsin in the market, it is, nevertheless, the most prescribed. Its purity and solubility, combined with its great digestive power upon albuminoids, have inspired physicians of a su... mind to try it also as a solvent for d... membranes and coagulated blood in the ... The success also of these novel uses has ... become generally known to the profession ... the world. Physicians writing for samp... receive prompt returns.

Dr. Hollman (*Nederl. Weekbl.*, 18, p. 272) ... the case of an old man, aged 80 years, s... from retention of urine, in whom the introd... of a catheter failed to produce the desired r... It was found that the bladder contained co... albuminoid masses mixed with blood. A f... after the injection of about 16 grains of Dr. J... Pepsin dissolved in water, a large amount of ... viscid, fetid fluid readily escaped by the cat...—*London Medical Record.*

Dr. Edwin Rosenthal, acting on the sugg... of Dr. L. Wolff, has used an acidulated c... trated solution of pepsin as an applicati... membranes of diphtheritic patients, for wh... seemed to be no other help than tracheot... reports that it acted like a charm, dissol... membranes, admitting a free aëration of th... and placing them soon on the road to convales... The solution he used was:

℞.	Jensen's Pepsin,	ʒ ...
	Acidi Hydrochloric, C. P.,	gtt. ...
	Aquæ q. s. ft.,	fl. ℥

M. S.—Apply copiously every hour with a ... mop.—*From the Medical Bulletin.*

Formula for Wine of Pepsin:

℞.	Carl Jensen's Pepsin,	gr. ...
	Sherry or Port Wine,	℥ ...
	Glycerin puris,	℥ ...
	Acid Tartaric,	gr. ...

Sig. f ʒ j. after meals. This is three gr... the pepsin in each teaspoonful.

For severe attacks of colic it has afforded ... relief, after a few doses have been given ... intervals, when other remedies have failed.

CARL L. JENSEN,

HOME OFFICE, 2039 GREEN STREET.

PHILADELPHIA.

THE

AMERICAN NATURALIST.

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THE SCALLOP AND ITS FISHERY.

BY ERNEST INGERSOLL.

THOUGH it had long previously been enjoyed by the shore-towns in New England, the introduction of the scallop as an edible into the New York markets is as recent as 1858 or '59. Now the annual product of the fishery, which is restricted in area and subject to much variation, amounts to something like 75,000 gallons in all, worth from twenty-five to thirty thousand dollars at first cost; and New York receives and dispenses about three-fourths.

The species of scallop in question is *Pecten irradians*, which is common in suitable places all along our coast. Besides this there are half a dozen other varieties, living at more or less depths, in the western Atlantic, one of which, the great *Pecten tenuicostatus* of the coast of Maine and the Bay of Fundy, was formerly highly valued by the people of that region, but now is too scarce to appear on the tables of even "the rich" except at rare intervals.

The fishery and methods of preparation for market of our scallops present several features of general interest, and I believe that in my study of the matter, a few years ago, as an agent of the Census Bureau, I was able to learn some new and suggestive particulars as to the habits of the mollusk.

Though occurring in a scattered way far to the northward, it is only between Cape Cod and New Jersey that any commercial scallop-fishery exists, save at a few points on the Southern coast, as at Morehead City, N. C., for a small local trade. Even along this limited extent the fishing is not continuous, but can be followed with regularity only in restricted areas of Buzzard's bay, Mass., Narragansett bay, R. I., in Peconic bay at the eastern end of Long Island, and at a few minor points on the New Jersey coast. Long Island sound, New York bay, Sandy Hook and much of the Jersey shore, have been so thoroughly depopulated that any fishery for scallops there has been abandoned. Occasionally a supply appears at this or that point, but uncertainly and temporarily. I was told, for example, by the oyster-planters on the north shore of Long Island, that scallops were tolerably plentiful there (particularly at Northport) once in five years. Such a statement is puzzling, and leads to a study of the habits of the scallop in search of an explanation.

The proper home of this species (*P. irradians*) seems to be in fairly deep water on a firm bottom—either sand or tough mud; yet in many localities grassy beds (*i. e.*, eel-grass—Zostera) are resorted to by it, especially when young. The general habits and behavior of our American scallops, such as living in companies or "schools," moving about and darting to the surface of the water by a quick opening and shutting of the shells, to sink down again along an inclined plane forward, are familiar to all readers of natural histories, and closely similar to those of the European "St. Jacob's shells."

The spawn of our scallop is thrown out in early summer, and so much of it as becomes fertilized and is able, "catches" or "sets" on stones, sea-weeds and other firm supports, from the sheltered tide-pools down to a considerable depth. By the middle of July this "seed" is about as large as the head of a lead pencil, and it does not drop from its support for two weeks or more. The growth is so very rapid that the young scallops have attained about half their size by the time cold weather checks their advancement.

In November the young scallops, spawned the previous June, will be found in great numbers all along the clean shores of Narragansett bay from an inch to an inch and a half in diameter, and moving about very actively. Where eel-grass grows in great quantities, however, the young keep among it, clinging to the stalks until by their weight they bend them down to the bottom or break them off, and are swept away with the grass when it goes adrift in the fall. Should such a tenanted raft of sea-weed drift into a bay and rest there, as frequently occurs in Long Island sound, that spot will be colonized with scallops, even where none had existed before.

Great numbers, however, forsake the protection of the eel-grass, when old enough, and go "dancing" about the neighborhood till they hit upon the right kind of bottom, when they come to anchor, and stay there unless driven away by extraordinary winter storms. Under such an accident thousands of bushels may sometimes be driven upon the beach, where all are pretty sure to die by freezing. Referring to this point a Sag Harbor man told me that if possible, when driven before a storm, they will work to windward, and he assured me that he had seen them swimming in schools ten feet deep. These movements are all within narrow limits, however, for the restricted bounds of the fishing-grounds are pretty nearly the same from year to year, though often it is impossible to see why the scallops should not extend their range. The young are far more active and swift than the older mollusks. Late in the fall, however, there is reported to be a regular migration of adult scallops toward the shore, whereupon the fishing begins; but this statement is not well substantiated, I fear.

The size of the young scallops is little increased during the colder months, but in the spring a new period of speedy growth begins and maturity is said to be reached within a year. At any rate these mollusks will produce spawn in the June following their birth, and are ready for market the subsequent autumn. The rapidity with which they enlarge their bulk, but more especially their fatness, or proportion of flesh to shell, is remarkable. Thus a bushel of these mollusks will yield only about two quarts of "meats" in October, whereas a bushel from the same locality at Christmas will turn out a gallon.

The fishermen believe that scallops never spawn but once, and die before they reach the age of three years. I am not at all sure this is a fact to the extent alleged, but if so it presents a case where the generations follow one another so closely that there are never two ranks or generations in condition to reproduce at once (except in rare individual instances), since all, or nearly all, of the old ones die before the young become mature enough to spawn. If such a state of affairs exist, of course any catastrophe, such as a destructive winter gale or the freezing over for a long period of the water wherein they lie, by killing all the tender young in a district, will exterminate the breed there, since even if the older ones survive such a shock they would not live long enough, or at any rate be unable to spawn again, and so fail to start a new generation.

Similarly an unusual attack by natural enemies, or excessive dredging by men, might in one season extirpate the scallops of a whole bed or bay. To its active powers of movement and its migratory habits, the scallop must mainly trust for preservation as a race, and to the fortuitous drifting in of young upon rafts of sea-weed most depleted localities chiefly look for rehabilitation.

Whatever the explanation, the supply has certainly decreased along our coast during the past thirty years, even though at certain points—as in the Peconics—there seems no diminution. The huge, smooth-shelled *Pecten tenuicostatus* of the North, as big as a fruit plate, which formerly abounded on the coast of Maine, has now become so rare as to be a prize in the cabinet of the conchologist rather than an edible commodity—a result unquestionably due to over-greedy catching, and an effective reply to those men who told me that they thought the more the scallop beds were raked the more plentiful the mollusks became. Long Island sound no longer affords profitable fishing, and the depletion there is attributed by the local fishermen to the fact that in culling their dredge-loads the little ones were not thrown back. The same story belongs to New York bay and much of the New Jersey coast. The irregularity in respect to plenitude, and also of the size and fatness of these mollusks in the three localities—Buzzard's bay, Cowesett bay (R. I.) and Long Island—where they are still regularly taken, is steadily complained of.

Scallops are caught by hand-dredging from small sail-boats. The dredges are about thirty inches in width, have a scraper-blade upon the bottom, and in favorable weather several may be thrown over from each boat. In shoal water an iron-framed dip-net is sometimes used on calm days. It is pretty hard work, and entails exposure to very severe weather.

The only edible part of the scallop is the squarish mass of muscle (the adductor) which holds the shells together, and this part is skillfully cut out by "openers," who have their houses at the landing places where the dredgers take their cargoes to be sold. It is the buyer, not the dredger, who "opens" or "cuts out" the meat and prepares it for market. In some places men alone are employed in this work—at others women and girls for the most part, and they will earn from eighty cents to $1.25 a day. The work is performed with great dexterity. The motions of an expert opener are but three after the scallop is in hand. The bivalve is taken in the left hand, palm up, with the hinges of the scallop toward the opener's body. The knife—a simple piece of steel ground sharp, and with one end stuck in a wooden handle—is inserted in the opening of the shell furthest from the breast. The upper "eye" is severed through by this movement. A flirt at the same moment throws off the upper shell. The second motion cuts the lower fastenings of the eye to the upper shell and takes the soft and useless rim off. The last motion pitches the shell into one barrel and the soft and slimy rim into another, while the eye is thrown into a basin of yellow stoneware holding a gallon. They are then poured from the basin into a large collander, thoroughly washed, placed in clean boxes and shipped to New York and Brooklyn. As little fresh water or ice is placed in contact with the "meats" as possible, as it is thought detrimental to their firmness and flavor. As this is altogether a winter operation, the help of ice in transportation is not usually needed.

There is, or ought to be, no waste in the scallop fishery. On Long Island the refuse is taken by the farmers as manure. These sea-faring agriculturists have always been accustomed to replenish their half-exhausted lands with the scrapings of the beach and with the menhaden and other seine-fish which could be caught plentifully enough for the purpose in the offing—much to the disgust of every stranger who found himself to leeward of their fields. This demand failing, there is always sale for the refuse to the regular fertilizer-factories scattered along the shore.

The shells are preferred above all others by the oyster-planters as "stools" or "cultch" to spread upon their deep-water planting beds as objects upon which the oyster-spawn may "set" and grow. This wise preference is due to the fragility of the scallop-shell, permitting it to break into pieces under the strain of a growing cluster of oysters, each one of which will be benefited by the separation, which frees it from the crowding of its fellows and gives it room to expand by itself into comely and valuable rotundity, instead of remaining a strap-shaped distorted member of a coalescent group. All their shells, therefore, can easily be sold by the openers to the oystermen at from three to five cents a bushel.

The scallop fishery is of small moment in the United States beside the production for market of oysters and clams, and the statistics (for which I am chiefly responsible) are meager, and not later than 1881, though I doubt whether this year's figures would show much difference from the status of five years ago.

Briefly summarized, these show that about 250 men (and for a short season at New Suffolk, Long Island, about 470 women and children, according to Fred. Mather), are engaged in either catching or preparing scallops, using boats and apparatus worth perhaps $20,000.

The total product is from 70,000 to 75,000 gallons of the edible part, as marketed, worth at first hand from $25,000 to $30,000. About one-half of this comes from Peconic bay, and more than half the remainder from Greenwich, Long Island.

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SUPER-METAMORPHISM AND VULCANISM.[1]

BY THEO. B. COMSTOCK.

IF it be true that metamorphism has converted Archæan sedimentary strata into the crystalline condition in which those beds now usually exist, there can be little doubt that some igneous rocks have had a similar origin. We can not detect the direct evidence of such previous condition in the thoroughly fused masses, but there is in many cases no real proof to the contrary, to say the least. Now, if these simple postulates be admitted, how can we consistently deny the possibility—nay, the probability—of the occurrence of all degrees of metamorphism from the simple baking to the melting effects? Geologists have commonly supposed that a well-defined zone of metamorphism has existed over the earth involving just so much of the sub-stratum of the crust, never passing the boundary set by the lowest member of the Palæozoic series. This view does not comport with the very gradual transitions observable in all other natural products, nor can it be reconciled with the numerous facts which go to prove that the great geologic agents of the past are active now as then, in kind if not in degree.

Really, then, it would be marvelous if extended study of geological history should not reveal fluctuations of the metamorphic zone, above and below the arbitrary stratigraphic boundary adopted in the early days of our young science.

[1] Abstract of two papers read before Section E, A. A. A. S., Buffalo, 1886.

Without arguing this point further, I desire to present here some facts which seem to indicate that true Palæozoic strata have in one region (S. W. Colorado) become involved in the zone of metamorphism; that is to say, *super-metamorphism* has occurred. All along the Rocky Mountain chain to the northward the Silurian beds are recognizable, although I have seen them very much baked in portions of Northwestern Wyoming. The same succession of strata from top to bottom of the Palæozoic is discernible southward, as a rule, until we strike the great loop of the continental divide in the San Juan mining region, where the sedimentary formations skirt the base of the Quartzite mountains of Hayden's survey. Here the Carboniferous and the underlying Devonian are well represented, and insignificant remnants of supposed Silurian strata occur *in situ*. In some cases these last-mentioned rocks shade down gradually from the unmodified sediments to the completely metamorphosed layers, and occasionally the Devonian limestone is so intimately connected with the subjacent granite as to form a continuous block of the two rocks *welded* together into one mass. Beneath the granites is a vast formation of quartzite, and the whole section studied by itself and in connection with the succession of strata in the adjoining country, seems to me wholly inexplicable upon any other theory than that of super-metamorphism, involving a considerable thickness of the early Palæozoic beds, including nearly all of the Silurian formation.

This idea, although worked out independently by myself, was, I find, entertained some years ago by Dr. Endlich, who passed rapidly over a part of the region in 1874. The importance of the fact, if such it be, of this super-metamorphism appears very evident when we come to study the history of vulcanism in Colorado and Wyoming. From observations by the writer in the latter area, in 1873, there seems no doubt that very similar conditions have existed in that great focus of eruption, although the results have been there much obscured by the lava flows and less disclosed by subsequent erosion.

Referring to the preceding remarks on super-metamorphism, we may understand how, with a crust offering excessive resistance, the igneous fusion may be longer continued than in the case of a volcanic eruption like those of the early Tertiary in the West or the Hawaiian initial outflows, all of the andesitic type. Von Richthofen's series, as exemplified in the order of succession of the lavas of the Western United States is, in the rough, of such wide application that we must expect to discover more than a mere accidental cause. The occurrence of only one type of lava, as andesite, trachyte, rhyolite, or basalt, may be readily explained as due to the overcoming of the resistance to outflow at one or other stage of the process of fusion. So, in certain wide areas, it might be possible for all of Richthofen's types to be ejected from as many distinct orographic centers. But in Wyoming and Colorado two great districts have the old volcanic vents so related to each other, in the several flows, that one can not avoid the conclusion that each field has been the seat of one long-continued period of activity marked by successive epochs of eruption. Thirteen years of study in these regions have revealed many facts bearing upon these questions. Having elsewhere outlined a plausible theory of vulcanism,[1] based upon these and general information gleaned from the West Indies in merely traversing that region, together with the published accounts of leading authorities, I shall not here attempt a discussion of it, but confine myself to a simple statement of its main points.

In brief, then, it seems evident that the earliest volcanic outflows came out through lines of least resistance in the axes of folds in the strata. In cases where these lines coincide with the major folds and the lines of maximum tension, the outflow will be andesitic or basaltic, *i. e., basic.* If the tension be not sufficient to overcome the resistance, more acidic material will be formed at the top of the magma, under the folds, and this may burst forth as trachyte, or finally as rhyolite, provided that the resistance is not sooner overcome. Basalt comes last as the deep-seated, heavier portion of the magma, and in some cases this follows andesite without the intervening trachyte and rhyolite.

In the San Juan mining region and in the Yellowstone Park area, the necessary conditions for the successive ejections have been brought about by a somewhat complicated series of foldings, cross-foldings and faults, accompanied by an *elastic* crust of siliceous material. The subject is one which can be studied in these regions to great advantage, but we are only beginning to understand how simple is the problem which nature has solved with much variety of detail to suit changing conditions of environment.

[1] The Geology and Vein-structure of Southwestern Colorado. By Theo. B. Comstock. Transactions Institute of Mining Engineers, Bethlehem meeting, May, 1886 (4 maps). Reprint, pp. 24–29, *et seq.*

ZOIC MAXIMA, OR PERIODS OF NUMERICAL VARIATIONS IN ANIMALS.

BY L. P. GRATACAP.

NO feature, perhaps, in his geological and field study affords the palæontologist more interesting material for his speculations on the conditions of the past, in its zoölogical bearings, than the irregular distribution of organic remains in the fossil-bearing rocks. Not only in the same geological horizon will he find striking variations in the abundance in which the fossils occur, as he passes from layer to layer of contiguous and often of the same beds, but he soon discovers the important fact that localities are distinguished by peculiar fossils, that a limited range circumscribes the lateral as well as the vertical diffusion of a species, as far as regards *numerical concentration*, and that again points or limited areas present, in overflowing numbers, representatives of an organism which, generally occurring throughout a wide geographical range, are at these points illustrated in crowded and exuberant colonies.

The well-known *fish beds*, located by Newberry and Worthen in the Lower Carboniferous limestone of Illinois, are examples of the first case mentioned, the remarkable localization of forms in Wisconsin, instanced by Chamberlain and by him denominated as evidences of "colonial tendencies," is an example of the second, as also to some extent, though these are perhaps in the main instances of a different class of facts, the faunal stations of Williams so admirably depicted in the papers on the "Fossil Faunas of the Upper Devonian,"[1] while the interrupted display of the same species in the same line of outcrop in respect to the relative numbers of specimens to be seen or their local disappearance when the area examined has any considerable extent, corresponding to a beach line of miles in length, illustrates the third class of facts which we refer to, as the diminishment westward from Genesee of Pentamerus in the Clinton rocks of New York.

Associated with these familiar facts is the closely related one of the contrasted size of the same fossil species in different parts of the same formation, a difference of size not always explicable on the mere assumption of favorable or unfavorable environment, of which perhaps the Spergen Hill fossils afford a very pertinent

[1] Bulletin U. S. Geol. Surv., No. 3.

illustration, for, as pointed out by Professor Whitfield,[1] the diminutive fossils of some molluscous species found at Spergen hill became, at Paynter's hill, a little over a mile west of the former locality, much larger, while the Bellerophon and Euomphalus of the Ellettsville, Ind., beds, greatly exceed in size the same species from Spergen hill, and in a less striking way collectors have become familiar with certain localities where certain fossils assume an unusual or handsome size contrasting with their depauperate appearance elsewhere.

A great deal of instructive and careful study has been expended in recent years, since the advance of research has made naturalists better acquainted with the oscillatory character of faunal populations, upon the perplexing question of the contemporaneity and succession of fossil faunas, and Barrande, Etheridge, Hall, Hull and Gosselet abroad, and Williams, Walcott, Call, Clarke and Matthews at home, have pointed out some of the details of their results in this investigation, and have already familiarized the scientific world with the important conception that varietal faunas or modification of a central or controlling animal facies, or even sharply contrasted zoölogical aggregations of species may belong to the same epoch and be laid down in the neighborhood of each other on the same oceanic or lake flooring.

Our intention here was not to discuss the variations of specific forms in the fossil-bearing rocks as throwing light upon the synchronous existence of different faunas, their succession, retreat, reappearance and fusion. It is undoubted that these assumptions explain and are indeed the chief explanations to be offered for the varying character of near-lying fossil groups; but we wish to urge upon the consideration of palæontologists the necessity of allowing—as far as regards the instances of fossil distribution cited above, viz., the greater or less prevalence at near horizons or beds or along the horizontal extension of the same bed of the same fauna or species—for those irregularities of production of life, which cause in our present seas different years to become distinguished for a phenomenal abundance of certain forms, as others to claim a distinction for the abnormal decrease or disappearance of the same forms over the same geographical area. Thus a given spot on a coast line, always yielding a particular species, may in one season become the abode of numbers of these

[1] Bulletin Amer. Mus. Nat. Hist., Vol. 1, No. 3.

same animals out of all proportion to its ordinary *census of occupation*, and in another season pass, by an abrupt change or perhaps through a series of less violent alternations, to a condition of comparative or actual denudation of these residents. The work of the Fish Commission has made us familiar with facts of much wider import, when large sections of the oceanic basin have become depopulated. This latter case appears to be catastrophic in its causes, but comes within the scope of our suggestion as to the fluctuating fertility of a species. And the fact becomes sometimes apparent that in a restricted region commanding a more or less fixed supply of nourishment the size of the animals will increase in the years of decreased fertility, and correspondingly diminish in the seasons of enhanced productivity, a relation not unnatural.

To what extent we may parallelize these two classes of facts, the one dealing with the changing abundance of fossil shells or remains, either vertically or horizontally distributed in beds of the same age, and the other exhibiting the varying numbers, in separated seasons, of contemporaneous animals along our seaboards, or in our fresh-water lakes, or even, so far as we can determine, in the pelagic areas, is not at first, or in all cases equally easy to determine. But it is possible to review some considerations bearing upon the general question.

The observations which may be adduced as bearing on this question are necessarily widely scattered, and when found are for the most part concerned with those forms of life which subserve some industrial or economic uses, or with those in close relation with the former, as, for instance, the recorded irruptions of starfishes (*Asterias forbesii*) and "drills" (*Urosalpinx cinerea*) in different years upon our oyster beds. In classifying, however, the efficient causes which effect these variations of animal populousness, without entrenching upon ground more or less speculative, we may say that the changing abundance of animal forms in different years or localities arises mainly from:

1st. Opportunity for or difficulty in obtaining fecundation.

2d. Constitution, rate of growth, habits, etc., of organism.

3d. Character of habitat in relation to bottom.

4th. Phenomenal influences, as cataclysms, poisoned or heated waters, storms, destruction by enemies.

I. Opportunity for or difficulty in obtaining fecundation.—That this has an important influence in securing a great or small representation of the marine animals in modern seas is unquestioned, though it is always, of course, a variable function of the more or less rapid and safe methods nature uses for their multiplication. Dr. Brooks says:[1] "The most critical time in the life of the American oyster is undoubtedly the time when the egg is discharged into the water to be fertilized, for the chance that each egg which floats out into the ocean to shift for itself will immediately meet with a male cell, is very slight, and it is essential that the egg should be fertilized very quickly, for the unfertilized egg is destroyed by the sea water in a very short time."

Tryon has suggested that the swimming species of Cephalopoda may experience some difficulty in effecting sexual union,[2] and the observations of Steenstrup upon the many different ways adopted in this group of Mollusca for fertilization, justify the inference that under unfavorable circumstances individuals of the same group may not encounter each other, and the chances for the fruitage of the same genera be diminished in exact ratio to the opposite plan pursued by its congeners for their fecundation. With some of the gastropods sexual union is effected directly, and no danger is incurred from the exigencies of the unprotected female ovum searching for the spermatic vesicles in the water. This establishes a safeguard which favors the multiplication of those prosobranchiates which possess it, but in other groups (Trochus, Scutibranchs, Cyclobranchs) the male elements are discharged into the water, and are then taken into the uterus. This introduces a risk which must increase or lessen according to the presence or absence of predatory fishes who devour the spat, the favorable stillness of the water or its temperature, or chemical condition, which if abnormal would destroy the germs.

Professor Morse[3] has described the difficulty, arising at a rocky point at Eastport, Maine, of the larger males of *Buccinum undatum* securing contact with the diminutive females secreted in the narrow apertures and crevices of the ledge, a state of things which at first would have a tendency to reduce the number of the individuals until a sufficient number of small males were evolved

[1] Bull. U. S. National Mus., No. 27, p. 210.

[2] Manual of Conchology, Vol. I, p. 42.

[3] Proc. Boston Soc. Nat. Hist., Vol. XVIII, p. 284.

to maintain the most complete generative activity, though this very contraction of size might diminish vitality, disarrange the seminal function and result in sterility.

The orders of Cladocera, Copepoda and Ostracoda will, in this respect, be favorably placed in comparison with other crustacean groups, as in these tribes fertilization of the female lasts during her lifetime, or at least a season, and in some cases the young females are born fertilized from the impregnated mother. Thus favorable conditions with these groups gain a predominating influence, as they fortify and assist an already preëxistent advantageous arrangement for security of fecundation.

Amongst fishes advantage will be given to those whose spawning season is most extended, as with cod, with which, according to the observations of Professor Sars, it extends over nine consecutive months, "a period exceeding that required by any other species of which we have any knowledge."[1] These are not only more likely, with equal vitality, to produce a larger number of individuals, but they are absolutely favored, by the greater extension of time, to escape variable inimical circumstances, which latter, being limited in duration, might, if coincident with the shorter period of other fishes, greatly impair the prospects of successful fecundation. The longer period of the cod renders its partial or entire escape from such disasters more probable. The spawning season for an individual of shad, salmon, or white fish is only a few days. But the likelihood of impregnation seems to be diminished on spawning grounds where strong currents are found, or during storms, as immense numbers of the eggs are driven on the shores, or are so diffused and distributed as not to meet the milt of the male, and as the egg of the cod quickly loses its vitality, great numbers perish. Under very favorable circumstances such conditions for impregnation might prevail as would result in an enormous excess of individuals produced, whilst an opposite state of affairs would reduce the production to a minimum. Again, an insufficient supply of males would greatly modify the results of fecundation, as the extraordinary fertility in eggs of the female amongst fish necessitates the presence of several males to accomplish their fertilization. Eggs of fish which are of such a gravity as not to rise to the surface, unlike those of the cod and mackerel, come less in contact with the destructive

[1] Bull. U. S. Fish Commission, Part v.

agencies of the surface, and increase their likelihood of fecundation by the longer possible period thus secured for a greater number.

Such fish as spawn in rivers or in the later seasons, as early summer, may be in some instances, or most, more likely to perpetuate a greater number of offspring than their congeners whose eggs in the ocean are exposed to greater risks of destruction or at seasons when storms are prevalent, though this consideration is again modified by the possible presence in either case of more numerous enemies.

II. Constitution, rate of growth, habits, etc., of an organism.— It is obvious that conditions favorable for the preservation and maturization of individuals will prevail when these conditions harmonize with the habit and life-history of the organism, and that the reverse will ensue when they do not, and other things being equal we may expect those species to predominate at a locality whose habits, life-history, etc., are either best adapted to the conditions of that locality over its competitors, or are of such a character as to withstand conditions which, generally unfavorable to all forms of life, are met by it with better safeguards and greater resistance.

Under unfavorable conditious the longer time in which the young of a marine shell are free before attachment, the less chance for a survival of a great number, and at such a time a selection would be effected in favor of those species whose spat most quickly came to rest, and these would subsequently become phenomenally frequent.

Again, the power of an organism to endure change of temperature, as compared with others less able to survive variation in this respect, obviously works in its favor, and may lead to an *apparent* excess of individuals. As Semper says,[1] "a small fall in temperature may be as injurious to one animal as a great fall to another, while a third species may be wholly unaffected by either." Möbius has designated animals under this regard as *eurythermal* and *stenothermal*, as they are qualified to endure great or small variations of temperature. This will also have an important influence on size, as Möbius has shown that the same species of mollusk living on the coast of Greenland or in the Baltic was in the former case large, in the latter dwarfed, and he at-

[1] Animal Life, p. 105.

tributed it to the variable temperature in the latter locality. Rate of growth as it is rapid or slow, continuous or periodic, will affect the numerical display of a species. Thus *Pecten irradians* grows very quickly, stops in winter, beginning again when the scallops are one year old, and on the whole this irregularity may be regarded as tending to diminish numbers. Power of locomotion again assists its possessors to escape from unfavorable surroundings or from enemies. Swarming or migratory habits, as with lobsters, affect the numerical proportion of the species at a given point in certain seasons, but probably has little influence on the fertility or abundance of individuals. Those animals, as crustaceans, which cast their integuments, are exposed to accidents during their exposed period, and should they then be subjected to especially destructive influences would suffer great numerical depletion.

III. Character of habitat in relation to bottom, temperature, depth, isolation, salinity and supply of food.—The overwhelming importance of these very variable factors upon the numerical exhibit of a species is most evident, and has, from many points of view, been emphasized by naturalists. Thus the nature of the bottom exercises a predisposing selective influence upon molluscous distribution. It is well known that oysters are killed in the mud, that the round clam affects sandy and muddy shores, the edible muscle flourishes in a variety of positions and surroundings, that the Purpura loves rocky headlands, and so on indefinitely. Thc temperature of the water exercises an accelerating or retarding influence upon the growth and spawning of both shells and crustaceans according to their nature in this respect, and the increase or decrease of heat. In the matter of living at different depths, animals vary extremely, and the sudden settling of a shore or even rapid secular change would tend to destroy the classes of shallow-water loving organisms. Isolation permits close interbreeding, subjects the species to more uniform conditions, and if it diminishes the volume of water seriously modifies the size, as shown with Lymnæa by Semper and Hilger, while of course it induces peculiarities of local development. Salinity varies in sea water and enclosed areas of the ocean, and distinctly modifies the abundance of animal life. The character of the supply of food and its abundance is an obvious element of great importance in the production of sea animals.

IV. Phenomenal influences, as cataclysms, poisoned or heated waters, storms, shocks, destruction by enemies.—It is enough to mention these to suggest their frequent occurrence. But the effect of these in geological time has been, doubtless in some case, to produce deposits of animal forms in sudden abundance, as when a fauna by their action has almost simultaneously disappeared. Thus Dr. Newberry has suggested that the fish beds of Illinois afford evidence of a wholesale destruction of fish life, possibly through submarine explosion, diffusion of poisoned vapors, etc., while the phenomenal disappearance of animal life from the Atlantic, as shown by the observations of the Fish Commission in 1881, is a modern instance of a widely extended catastrophic obliteration of animal forms.

Zoic Maxima.—It is evident that if all the above conditions were favorably conjoined for some reasons, in accordance with the needs of any special organism or any group of organisms, that these would attain probably an unusual fertility, and that if passing such a climax as this the succeeding years would develop conditions in the same way, as strikingly unfavorable, we would have in the marine deposits, accumulated during these years, two contrasted beds of respectively rich and barren contents connected or graded into each other by intervening beds of diminishing productivity in shell remains. But if after a period of phenomenal activity and success in the production of forms such as instanced, a disaster, such as those we have suggested under the fourth heading, took place, then we would have a bed gradually reached through lower beds of increasing numerical strength until it crowned the series as a climacteric to be succeeded by later layers quite devoid of animal remains.

These periods, when all the conditions are most favorable for animal multiplication, we designate as Zoic Maxima; and as they are in accordance with the requirements of the greatest number of specific forms we call them Pan-zoic Maxima; or as they are so combined as to exert a selective influence, permitting the preponderance of one or a few species, or directly contributing to the propagation of this one species both in numbers and in size, we call them Sol-zoic Maxima.

It is certainly true and known that such Zoic Maxima, both in their general and restricted manifestations, are known in our contemporaneous faunas. It is probable that the varying abundance of fossil remains in the beds of fossil-bearing rocks are due to similar causes.

THE PEABODY MUSEUM'S EXPLORATIONS IN OHIO.

BY F. W. PUTNAM.

I CAN truly say a new chapter has been added to our archæological work in the valley of the Little Miami. First, you must know that our camp is pitched by the side of the great pile of earth we turned over in our explorations of the group of altar mounds on the land of Mr. Michael Turner. We have been working, with occasional necessary intermissions, on this and the adjoining farm of Mr. Benjamin Marriott for the past five years, and this is the place where we have discovered so much of interest within the great earthwork of which the following is a sketch:

A hill through which two ditches, thirty feet deep, had been cut, separated the hill into three parts. Around the central portion a wall of earth had been raised, making a perfect circle 550 feet in diameter. In this inclosure was a large mound, and near it a small one. These mounds proved of great interest, particularly the large one, with its stone wall four feet high, surrounding an altar of burnt clay. We found several human skeletons in the clay outside of the stone wall and two others on the wall, with various objects made of copper, shell and stone. The earth taken from the ditches was used to make the graded way from the top of the hill to the level land below. This graded way connects with an embankment of earth, somewhat oval in shape and 1500 feet in its greatest diameter, in which are two openings. Opposite the northern opening is an earth circle 300 feet in diameter, and in this is a small mound which we have not yet explored. Opposite the eastern opening is a mound nine feet high. It was on this mound that we began our work at this place five years ago. At the foot of the graded way is a small circle inclosing a burial mound. North of this circle were two other burial mounds, and east of it was the great group of altar mounds, around each of which was a wall of stones four feet high, built below the surrounding level of the field. These mounds contained from one to seven altars, formed of clay, on which fierce fires had been made. It was in two of the basins of the altars in the mounds that I found the immense number of ornaments of various kinds, particularly of copper, the 60,000 pearls, shell-beads and other objects, also the wonderful little figures of terra cotta representing men and women. All these objects had been thrown into the fires upon the altars, evidently as sacrifices or burnt offerings during an important ceremony. The thirty-seven pits with the singular tubes or "flues" connected with them; the concrete layer of gravel and iron over them; the singular structure of the great mound, a hundred feet in diameter and twenty feet high; the great pit containing the many skulls, some of which had holes drilled in them, arranged around two skeletons placed in ashes, all serve to show that connected with this group of mounds were extensive ceremonies of the deepest import to the people.

These extensive earthworks, made on such an elaborate scale, and containing evidence of the wealth of the builders as well as of the ceremonial character of the works themselves, necessarily lead to the conclusion that there must have been a large number of people connected with their construction. The beautiful location of this group of earthworks on the level second terrace which extends for miles in the fertile valley, and is surrounded by hills from which flow never-failing springs, indicate that in this region there must have been a large population; yet the few human remains which we found in the mounds within and without the encircling wall are not sufficient to meet the requirements. Such remains were probably those of distinguished persons, buried with special honors; but where were the other dead? Then the many altars, or basins of burned clay, which evidently had been used over and over again, and were, with two exceptions, empty when the mounds were erected over them, are indications of cremation, and yet where were the burnt human remains? Cremation in open fires will, necessarily, leave many fragments of calcined bones with the ashes, unless such remains are burnt over and over again, and special pains taken to reduce all to ashes, and yet we had found, in a niche of the stone wall about the large altar mound, the burnt bones and ashes of but one individual. If these altars were the places where cremation took place, what then had become of the remains? These were questions which Dr. Metz and myself often asked of each other, and we felt confident that somewhere near by there must be a general burial place for the common dead, and many a hunt was made for surface indications. On the north and south sides of Mr. Turner's barn, and west of the large circle, are two scarcely perceptible ridges, similar to other slight irregularities here and there over the field. Owing to the cultivating of this place for many years and to the tramping of cattle in the barnyard, these ridges have been more or less worn down, and a few water-worn stones have been exposed on the surface. These were first noticed by Dr. Metz about a year ago. As soon as our camp was pitched we took a look at these water-worn stones. They were fragments of limestone filled with fossils of the Silurian age lying on a deposit of gravel over which, long ago, had flowed the waters of the Little Miami. What more could these stones have said, had they been endowed with speech, than that which was evident to our eyes: "We were long ago brought here by men." Here, then, was something more to be revealed in connection with the history of these great earthworks of an ancient race, and here we would dig a trench on the morrow. We started our trench sixty feet west from the wall of the circle, and well outside of the slightly elevated portion, which, we were afterward told by Mr. Snyder who remembers the place fifty years ago, was formerly much more marked, and had the appearance of a long low mound. Digging down to the hard pan, we carried our trench westward for about ten feet, when we came to three large water-worn stones regularly arranged, side by side, in the gravel hard pan.

It is necessary to fully understand the character of the earth in which we were working in order to appreciate the labors of the ancient people at this place, and I may well add our own in making these researches. First, the surface consists of a few inches of dark soil overlying from eight to ten inches of clay. Under this clay is a layer of coarse gravel containing many pebbles, some of considerable size, but all colored and firmly cemented by an amount of iron which, from some natural cause, is far in excess of that in the gravel all about. This iron-cemented gravel forms an irregular layer of from one to four feet in depth, and under it is a loose, uncolored gravel mixed with sand which, judging from a pit near by, is certainly thirty feet in depth, and probably much more. It may be that this is part of the great terminal glacial moraine which Professor Wright has been tracing across the State of Ohio. In this iron gravel the stones we found were imbedded. On cleaning off these stones we found that there were others at right angles to them, and soon we made out that we had at last discovered a grave. Would it prove to have any connection with the people who built the earthworks and the altar mounds? Our hopes were great, and they were soon to be realized as far as one grave could tell its story. On carefully removing the earth from the eastern end of the grave, close to the stone, we discovered the toe bones of a human skeleton, and after several hours of the hardest kind of trowel digging, we had the satisfaction of exposing the skeleton lying at full length on its back. Its skull, slightly turned to the right, rested on a flat stone at the western end of the grave. On the left side of the skull was a large sea-shell of the genus Busycon, from which the central portion had been removed, a common method of making vessels among the various peoples of America, and often found in burial mounds and graves from the Gulf States to Michigan. With the bones of the neck were several shell beads, also of a common form, and as widely distributed over the country as the Busycon shells. The arms were extended at full length along each side, and inclosed by the bones of each hand, resting on the hips was a spool-shaped ornament (which our explorations have proved to be ear ornaments) made of copper, and like those found with several of the skeletons in the mounds of this group. We have at the museum ear ornaments of this character from burial mounds in various parts of Ohio and west to the Mississippi in Illinois, and from Central Tennessee, but I have never found them in any of the several thousand stone graves of the Cumberland valley which I have explored, nor have we found a trace of them among the several thousand graves associated with the singular ash-pits in the cemeteries which we have explored in the Little Miami valley, nor with the skeletons buried in the stone mounds nor in many of the simple burial mounds of Ohio. They seem to be particularly associated with the remains of a people who practiced cremation to some extent, and who built many of the great earthworks of the Ohio valley. That it is an ancient form of ornament, made from native copper, there can be no doubt, although they may have been made also by the descendants or conquerors of this people in later times; and it is not at all improbable that the form of the ornament may have survived to the time of contact of the "red race" with the white. I can only say that in all the recent Indian graves I have opened or know about, this peculiar character of ornament has not been found; and if they were ever made by the whites and furnished to the Indians, I have never happened to find any that showed evidence of the fact. We have certainly found them under such conditions in Ohio that they must have been buried with their owners long before the discovery of America. Then again, all we have found have been made by hammering pieces of native copper, and not by casting the metal.

By the side of the right tibia of the skeleton in the grave was a copper pin, a wooden bead covered with thin copper, a few long, slender flakes of flint, and a fragment of some kind of an ornament made of shell. These long flint knives are of the same shape and character as the well known obsidian flakes from Mexico, and we have found them, as a rule, associated with copper ear ornaments like those in this grave. They are sharp edged, and are as good knives as the Mexican flakes. While speaking of them in general terms as flint, they are in reality flakes struck from several varieties of stones, many of them being of a bright red jasper and others of chalcedony. The wooden bead covered with copper is of the same character as others we have taken from the burial mounds in which we have found the copper ear ornaments. Close to the right hand and hip, but two inches above them, and covering a space a foot in diameter, were a mass of fragments of burnt human bones, with bits of charcoal mixed with ashes. These remains of a cremated body had been gathered from the place where it had been burnt, brought to this grave and placed by the side of the body at the time it was laid in the grave. The close contact of the remains to the finger bones of the skeleton, which were not disturbed, was sufficient evidence of this. Here, then, in one grave, we had found the evidence associating it with the altar mounds and the rest of the earthworks about, independently of the fact that the grave itself was within the earth wall surrounding all the other works. We had found evidently the burial place of the people, and this was abundantly confirmed as our work progressed.

We have now for two weeks been engaged in exploring this burial place, and during this time we have discovered eighteen graves, four large deep pits, and several holes dug in the gravel, as well as places where there had been fires, and numerous other interesting facts, many of which by themselves would be trivial, but which, when they are all put together, will give a far better idea of the customs and works of the people who made the great earthworks in Ohio than it has been possible heretofore to obtain. All other explorations in the State have been fragmentary. No other systematic work has been attempted, and hence we have had plenty of theories built upon partial facts. We have much to do before the exploration is completed even of this single group.

To give a detailed account of all we have found during these two weeks would, I fear, draw too much on the patience, and I shall only call attention now to a few of the more interesting points. Individuality had its exemplification in this old cemetery, the same as it has in our modern ones, and the modifications are so great that no two of the graves thus far discovered are alike. In one instance there were no stones about the skeleton; in another a carefully built wall had been made of long, narrow, flat stones, and a regular wall, four layers high, had been made in the same way that a mason lays bricks, but without mortar. In some graves flat stones were placed at the bottom; in others the skeleton was firmly imbedded in the gravel, while in one the body had been placed on a thin layer of clay placed over the gravel. In one grave there were two skeletons, one extended at full length on its back and the other crowded into the grave by the side of the right leg of the first. A child was placed in a small circular grave, the body having been so arranged that the head and the feet were not far apart. Most of the graves were comparatively shallow, extending from six inches to a foot into the layer of gravel. The deeper the grave the better the condition of the skeleton. One grave was dug to the depth of nearly four feet in the gravel, and was seven feet long by four in width. At the bottom was a pavement of flat stones, fourty-nine in number. On these stones the body had been extended, and the grave had been filled up with over three hundred stones, all of which had been brought from the river bed, nearly a quarter of a mile distant. Over these stones six inches of gravel had been placed, around and over which other stones had been regularly arranged. The free percolation of water through the stones had filled up the grave and caused the skeleton to decay, only a few fragments being left. The graves were not covered with large stones, as is the case with the stone graves of Tennessee, and there is but little in common between the two. Another class of graves were basin-shaped, small in size, and carefully made of flat stones. In them we found burnt human bones and ashes. In one was a pipe carved from stone which had been burnt with the body, and in another were fragments of a burnt copper ornament.

I must give an account of the graves which were of particular interest.

Grave No. 5 in our notebook was six feet six inches long, two feet nine inches wide, and one foot eight inches deep, measured from top of the stones. It was made with care, and the stones were carefully placed so as to form a substantial wall. The bottom was completely covered by four large, flat stones, on which the skeleton lay on its back. The skull was at the east end of the grave. When the body was put in the grave the knees were drawn up, the left hand rested on the body, and the right was laid straight along the side. The result was that the bones of the left hand were found in close contact with the upper ends of the tibiæ, which had fallen down between the femora. In the bones of each hand was a copper ear ornament like those I have mentioned. In the corner of the grave, near the bones of the left foot, was a large sea shell, from which the central portion had been cut away. Near this was a little cup carved out of stone, two canine teeth of a bear, each with lateral perforations, and in each tooth was the chalky remnant of a large pearl. Close to them was a large crystal of galena, and a knife made of a long flake of flint. On the same side of the grave, nearly opposite to the shoulder and partly under the side stones, were eight of the copper ear ornaments in a bunch, and under them a long bone point. We did not discover them until we had taken out the skeleton and began to remove the stones, for it is our rule always to remove everything placed by human hands, and to turn over every inch of dirt previously disturbed. On taking up the flat stones, which were firmly imbedded in the gravel, and had their edges covered by the side stones, we found the following articles, which must have been placed where we found them before the stones had been put down. Under the second stone (there was nothing under the first) near the center was a copper bead and small thin pieces of iron, probably meteoric, but it has not yet been analyzed, and it may prove to be bog iron which has formed in that place. As we have found several ornaments made of meteoric iron on the altars of the mounds in this group, as well as two good-sized pieces of an iron meteorite, I strongly suspect that this iron will prove to be the same. Under the third stone, were two disks or halves of a copper ear ornament. These were several inches apart, and must have been so placed when the stone was put down. Near these was a wooden bead, with a thin covering of copper. Under the next, or fourth stone, were several of the long flint flakes or knives, and eight inches from the edge of the stone was a small copper celt. These deposits, under the stones of which the body was to be placed, certainly suggest the offerings of friends at the time the grave was prepared, and the various other objects placed in the grave with the body can, with equal reason, be looked upon as the property of the deceased, or as friendly offerings. At all events they are important as proof that the individuals buried here belonged to the people who built the mounds, as these several objects are of the same character as the many we have found on the altars, and with the few skeletons in the burial mounds of the group.

Grave 15 of our notes was remarkable for the care with which the walls, sixteen inches high at the head and foot, were made of four layers of flat stones, while along the sides, in the clay above the gravel layer, were simply a row of stones. The skeleton was lying firmly imbedded in the gravel, extended at full length on its back, with the skull at the west end of the grave, while the toe bones were against the opposite stones. The skeleton thus extended the full length of the grave, which was six feet three inches. As with nearly all the adult skeletons, there was a copper ear ornament in the bones of each hand. On the breast bone was a copper band. At the neck were two shell beads, and near the left shoulder was a flake knife. A few inches from the left foot were about twenty of the long flake knives, carefully laid together, as if they had been wrapped in a piece of skin or cloth when placed in the grave.

With two other skeletons we found celts made of soft coal. These were perfectly made, with fine smooth edges and polished surfaces, in exact imitation of the ordinary stone celt or hatchet; but as they would have been worthless for the uses to which stone celts were put, it is likely that they were ornamental or ceremonial objects.

I will allude only to one more grave, No. 18 of our notes. This was marked by a mass of gravel a little over seven feet long and nearly three feet in width, around the edges of which were small stones, eight to twelve inches long. This mass stood up eight inches from the gravel layer under the clay. Removing these stones and gravel, we found loose gravel filling a pit just seven feet long and three feet four inches wide. At the depth of two feet we came to hard undisturbed gravel, and on this was a human skeleton extended at full length on its back, with the skull at the south-east end of the grave. The bones were firmly imbedded in the gravel, and so dry that great care was necessary in removing this matrix. However, after six hours of unremitted labor with small trowel and brush, they and the several objects associated with them were all uncovered and left in place, even to the finger and toe bones, and a photograph was taken showing everything in place. In each hand was one of the copper ear ornaments of the kind I have referred to so often. The finger bones were so arranged as to show that these ornaments had been clasped in the hands at the time of the burial of the body. Another of these ornaments was on the neck bones in contact with the under jaw. On each side of the copper ornament was a canine tooth of a bear, with the lateral perforations. Partly over the bear's tooth, on the left side, was a piece of native copper, which had been hammered roughly into a flat, thick, irregular sheet. This is without holes, and is probably an unfinished ornament. Above this, and close to the skull, was a small copper cone, like many found on the altar of the great mound. Near the right shoulder was a large sea shell, like the others I have mentioned. This skeleton, as it lay in the grave, measured five feet ten inches from the top of the skull to the tip of the great toe, and the individual was not far from five feet four inches in height when living. With the exception of a portion of the sacrum, which had entirely disappeared, this skeleton was taken out in a perfect condition. The decay of the sacrum was owing, probably, to the fact that a small round stone had fallen in such a way as to allow water to percolate around it.

This skeleton is a good illustration of the absurdity of the common notion that as soon as skeletons which have long been buried are exposed to the air they fall to dust. I always have a quiet laugh when I read notices of that kind, and you may put all such accounts down to the inexperienced and clumsy work of the person removing the skeleton. The fact is that it requires great care to remove the earth from about the bones, and very few persons will take the time to do it properly. As soon as a bone is uncovered most persons attempt to remove it at once, and of course it goes to pieces. Now if a skeleton is in dry earth or gravel, and is very dry and crumbling, the proper mode of procedure is to uncover the bones with great care, loosening the earth with the point of a small flat trowel and removing it from the bones by means of a small broom, or clothes brush, then let the moist air come in contact with the bone, or, if the air is very dry and hot, sprinkle the bones with water and let them absorb all they will. In this way the particles of bone swell and interlock, and after a while the bone can be safely taken up by avoiding force in removing it from the earth. In case the bones are in wet clay or earth the matrix must be removed with great care. In such cases the bones are soft and spongy and they must be allowed to remain in place until they have dried off; but they must not be exposed to the full heat of the sun, otherwise they will crack and splinter as they dry. Of course instances often occur where we find only minute fragments of a skeleton in a grave, all the rest having passed through a chemical change and been reduced to its earthly particles; but that every bone found in a grave can be preserved by using proper care I know from long experience to be the case. I may also call attention to the fact that the state of perfection of the skeleton, outside of certain limits, is not evidence, by itself, of the antiquity of the bones, as the conditions of burial, as well as the character of the bones must be taken into account.

In our exploration of this burial place we found three large pits which were covered with gravel and stones, like the grave I have just described. These pits had been dug through the compact iron-cemented gravel below the clay, even to the depth of five feet, and all the material taken from them had been carried away. The pits were then filled with ashes and burned earth, and covered with several inches of gravel and stones, like a grave. The sides of the pit were not burned, so it is evident that the ashes were not from fires on the spot. There were several places uncovered by our excavations near these pits or graves where fires had been made on the clay or gravel, but the ashes had been removed, and hence it is probable that they had been put in these carefully marked pits. But what had become of the gravel taken from them?

It is to be remembered that in the great mound of the group of altar mounds there was a layer of gravel two or three inches thick, which we have called the concrete layer. This gravel was cemented by a large amount of iron, and it has been a puzzle where the iron came from. It was far too great in amount to have been derived from the clay in the mound above, and besides, the gravel of the same layer, about the edges, was loose and light without any mixture of iron. Now this iron gravel from the burial place is of the same character as that forming the concrete layer in the mound, and it therefore seems probable that these pits must have been dug for the purpose of obtaining it. As this gravel had been used during the extensive ceremonies which must have taken place at the time the mound was constructed, the very place from which it was taken seems to have been held sacred and the pits therefore filled with burnt material, covered over and marked in the same manner as some of the graves. This again is further evidence of the connection of the burial place and the ceremonies which took place there with the altar mounds. The more we examine into the details of this wonderful group of ancient works, the more interesting and instructive they become. We have already spread before us the outlines of a grand picture of the singular ceremonies connected with the religious and mortuary customs of a strange people. There are still some touches to be given before the picture is complete, but it is more perfect than any other that has been drawn, and as our work goes on we may yet be able to fill it out, and finally present it as a perfect whole.—*The Boston Herald.*

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AN INTERESTING CONNECTING GENUS OF CHORDATA.

BY E. D. COPE.

IT is well known that the only orifice in the cranial parts of the carapace in those so-called fishes of the Old Red sandstone, Pterichthys and Bothriolepis, is single and median, and is transversely placed, so as to cover the space occupied by the orbits and the interorbital region in such Vertebrata as have the eyes superior and close together. In the genus Cephalaspis, which has been also supposed to be a fish, two orbits and an interspace occupy about the corresponding position in the cranial buckler.

There is found, lying in the median orifice of Bothriolepis, a bony valve, which is quite free all round. This has been supposed to represent the interorbital part of the carapace, and the uncovered parts of the orifice, at each of its extremities, have been supposed to be the orbits. An examination of numerous specimens of *Bothriolepis canadensis* Whiteaves, has lead me to oppose this latter view. I have, on the contrary, considered the entire orifice to be probably homologous with the "nasal pouch" of the lampreys, and the mouth of the Tunicata and of the invertebrates.[1] This character, together with the absence of lower jaw, would refer the genus to the Marsipobranchii or class of lampreys, or to the Tunicata. From its considerable resemblance in the carapace to the tunicate Chelysoma, and in the lateral arms, to Appendicularia, I referred Bothriolepis provisionally to that class.

The Cephalaspididæ are more like fishes than the Pterichthyidæ, in that they have a distinct head and distinct orbits. They have, however, no lower jaw, and thus approach, if they do not enter, the Marsipobranchii. But they have no nasal pouch or nostrils, as has been observed by Dr. Lankester. This character separates them widely from either fishes or Marsipobranchii. It also gives color to the supposition that the orbits in this family represent the extremities of the median orifice of Bothriolepis.

A highly interesting specimen, which I owe to the kindness of my friend, R. D. Lacoe, of Pittston, Pennsylvania, throws considerable light on this subject. It consists of the cast of the cranial and nuchal buckler of a vertebrate allied to, but different from, the families above mentioned. The fact that it is derived from a higher geological horizon than any of them, that is, from the coal measures, adds to its interest. Besides the typical specimen other portions of a probable body-buckler are in my possession.

The characteristic peculiarity of this form consists in the fact that it combines the presence of orbits similar to those of Cephalaspis, with a median orifice between them, in the position of that of Bothriolepis. And this median orifice is divided into two equal parts by a narrow longitudinal septum. The parts are well preserved in the specimen, and perfectly distinct. The two median orifices perforate the middle of the region which is occupied

[1] AMERICAN NATURALIST, 1885, p. 289.

by the platé of Bothriolepis, but differing from it in being continuous anteriorly and posteriorly with the rest of the buckler.

This structure makes it probable that the median orifice of the Pterichthyidæ represents both protostome (nares) and orbits, and that these orifices have become differentiated in later forms. The protostome in Bothriolepis is covered by a probably movable valve. That the organ of smell should have been differentiated from a primitive mouth is altogether reasonable in view of the close relationship subsisting between these senses; but that the sense of sight should have had a common orifice is not to be anticipated. The recent remarkable discovery of a rudimental eye in the pineal gland of lizards does not throw much light on the subject, since true eyes coëxist with it in those animals, and the median eyes of the Pterichthyidæ had left the field long before the advent of Reptilia, in a phylogenetic sense. From a chronological point of view it is not unlikely that the present new genus brings such forms closer together, since there is little doubt but that the Pelycosauria of the Permian possessed large pineal eyes.

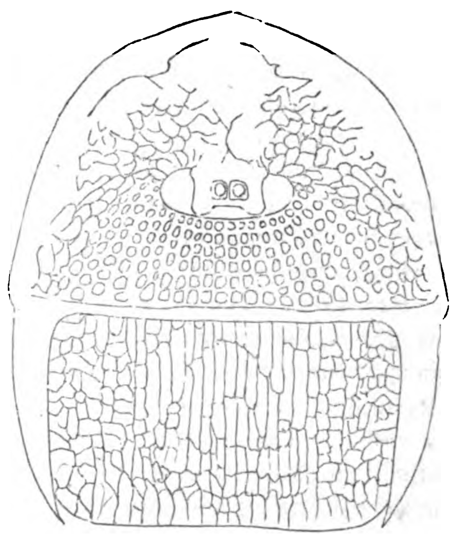

FIG. 1.—*Mycterops ordinatus* Cope. Cranial and nuchal buckler from above, ¼ natural size.

The new genus here referred to may be named Mycterops, and the single species which thus far represents it may be called *Mycterops ordinatus.* The generic character is as follows:

Cranial buckler undivided, terminating in an acute spine-like process at each postero-external angle, which is directed backwards, and without articulations. The space between these spines, occupied by a large undivided shield, separated by a transverse suture from the cranial buckler.

The species characters are as follows:

Muzzle broadly rounded. Orbits semicircular or widely crescentic, the flat or concave border inwards; the long diameter anteroposterior. Nares close together, each with a subquadrate outline, and separated from the orbit by a space a little greater than its own diameter. Their borders are slightly elevated, especailly above a shallow groove that connects the orbits behind them. Nuchal plate twice as wide as long, its posterior outline a little convex, its posterior external angle reached by the acute apex of the cephalic spine. The median anterior border of the cephalic buckler is damaged so as not to give its exact outline, but the muzzle was probably broadly rounded. The lateral borders are nearly straight, and they diverge to near the base of the spine. The external border of the latter is gently convex, and turns inwards posteriorly. The surface is marked by longitudinal lines of flat tubercles, or raised areas, which are separated by narrow grooves, and have various lengths. Those on the head are usually as wide as long; while those on the nape are generally much longer than wide. Those near the borders are always broken up, and those at the side and in front of the orbits are irregularly distributed. Cephalic border and spine smooth. The size varies. The type specimen has the head as large as a fully-grown *Amiurus catus*, but parts of others indicate individuals approaching double that size.

Returning to the presentation of the systematic relations of this form, it may be observed that in spite of its resemblances to the Pterichthyidæ and the Cephalaspididæ, it must be distinctly separated from both families. Supposing it to possess a ventral plastron like that of the former and Coccosteus, which is probable, we must not attach too much importance to the fact. It was on the presence of the carapace and plastron of these forms that Owen established his order of Placoganoids. But this character constitutes no greater bond than the possession of scales by many fishes; and equally heterogeneous elements are embraced in Professor Owen's division. Thus Coccosteus and Dinichthys have well-developed cranium with distinct mandibular and scapular arch. None of the elements of a cranium are distinguishable in the Pterichthyidæ and Cephalaspidæ, and neither of them possesses a lower jaw or scapular arch.[1] Mycterops must be associated with the latter. But it differs from both in the characters of its orbits and nares, and

[1] A pectoral limb has been observed in Cephalaspis, but no scapular arch.

must be kept well apart from them on this account. The relations of all these forms to known types may be tentatively represented in the following scheme:

Class TUNICATA.

Order ANTIARCHA. Vent posterior; ? mouth as well as protostome present.

Fam. *Bothriolepididæ.* Caudal region absorbed.

Fam. *Pterichthyidæ.* Caudal region present.

Class AGNATHA. Without lower jaw or scapular arch.

Subclass ARRHINA. No nares.

Fam. *Cephalaspididæ.*

Subclass MONORRHINA (Marsipobranchii). A single median nareal orifice.

Order HYPEROARTI (Myxinidæ).

Order HYPEROTRETI (Petromyzontidæ).

Subclass DIPLORRHINA. Two median nareal orifices.

Fam. *Mycteropidæ.* Cephalic and ventral bucklers.

Class PISCES.

Subclass 1. HOLOCEPHALI.

" 2. DIPNOI.

" 3. SELACHII,

" 4. TELEOSTOMI.

Order PLACOGANOIDEI. The structure of the fins of this order being unknown it cannot be referred to either of the three primary divisions (Crossopterygia, Chrondostei and Actinopteri) with certainty. Supposing it to belong to the last named, it agrees best with the Isospondyli, but apparently differs in the lack of some ot the elements of the suspensorium of the lower jaw. There is no sufficient evidence of affinity to the Nematognathi, which is probably a modern group.

The Mycteropidæ then occupy a position between the Antiarcha and Marsipobranchii (Monorrhina) on the one hand and the fishes on the other. They would, with the latter, enter the "cladus" Amphirhina of Hæckel, if that division be regarded as defined by the presence of two nareal orifices. But this disposition of them would violate truer affinities to the orders without lower jaw and scapular arch, for which the term Agnatha (Haeckel) may be retained. As compared with Cephalaspididæ, Mycterops approaches nearest to Didymaspis Lankester. The Mycteropidæ may be regarded as descendants of the Pterichthyidæ, and ancestors of the Placoganoidei. Since the latter occur earlier in geological time (Devonian) than the Mycteropidæ (Carboniferous), we may suppose that Mycterops is a descendant of a Silurian or Devonian type with a single median nostril, which will be a family of Monorrhina. From this hypothetical family the Arrhina (Cephalaspididæ, etc.) and the Marsipobranchii (lampreys) may then be regarded as descendants. The former lost nares by degeneracy; the latter are degenerate in other respects.

EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

—— The editors of the AMERICAN NATURALIST wish to call the attention of American students to the fact that their pages are open for the prompt publication of summaries of the results of original investigation, which for any reason it may be deemed desirable to place on record before the issuance of the completed account. Looked at merely as a means of securing priority, preliminary communications are not over praiseworthy. The credit of making a discovery should not be the sole end of investigation, and an attempt to hurry into print so as to forestall some other worker in the same line is not highly meritorious. The student of science should have a higher aim; and happily quarrels for priority are far less frequent than they have been in years past, thus indicating that a higher end has been sought. Preliminary communications have another value than the mere anticipation of another. They place before others, working in the same line, an outline of the results at the earliest possible moment, and thus often furnish invaluable assistance. Fully as great is their value to the student working in another line. The completed paper is usually long and frequently prolix, so that it is a severe drain upon the time to wade through it for the facts desired. The preliminary communication, on the other hand, is usually short and concise; it contains only the more salient facts and omits the larger part of the speculations. In this way it becomes more easily available for reference, while it does not withdraw from the value of the more detailed article. From these two points of view the preliminary communication is valuable and deserves encouragement.

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RECENT LITERATURE.

SMITH'S "ALBATROSS" CRUSTACEA.[1]—The dredgings of the U. S. Fish Commission steamer *Albatross* are turning up a wonderful deep-sea fauna, and placing the work done by American students in this direction at least on a par with that done in Europe. In the present paper 107 species of decapods are recorded as having been taken in the collections of 1883 and 1884, and of these but two are described as new in the present paper. Novel-

[1] *Sidney I. Smith's Report on the decapod Crustacea of the "Albatross" dredgings off the east coast of the United States during the summer and autumn of 1884.* Rep. U. S. Fish Commis. for 1885, pp. 101, 20 plates, 1886.

ties are, however, but a slight test of the value of any contribution to science, and the present instance is no exception. The principal feature of this paper is the extent to which it increases our knowledge of the bathymetrical distribution of the forms enumerated, and points out the coincidences between depth of occurrence and points of structure. These lists record forty-three species as coming from below the 1000 fathom line, while twenty-two were taken from a depth greater than 2000 fathoms. The greatest depth recorded is 2949 fathoms, and from a single station of this depth, about 350 miles east of the mouth of the Chesapeake the trawl brought up *Acanthephyra agassizii*, *A. brevirostris*, *Notostomus vescus*, *Hymenodora glacialis*, *Parapasiphaë sulcatifrons*, *Hepomadus tener* and *Sergestes mollis*. Of the pertinence of the first of these to these great depths some doubt is expressed, as at another time one was caught swimming at the surface. All of these forms it is to be noted are macrurous.

Some of the deep-sea forms are colorless, but most are of some bright shade of red or orange. Their eyes have undergone a careful superficial examination. In some the black pigment, the corneal facets and the like are much as in shallow-water forms, except that occasionally the eyes are smaller. In Munidopsis and Pentacheles the visual elements are apparently lacking, while in others the pigment is light colored and the visual elements are reduced in number. In some of the deep-water shrimps there is a curious accessory organ borne on the eye-stalks which may be phosphorescent in its nature. It certainly deserves careful histological examination at competent hands. In the eggs, too, a peculiarity is noticed. Among the shallow-water decapods the eggs are usually so small that it is a matter of some difficulty to cut sections of them, but in these deep-water forms they attain a very considerable size, those of *Parapasiphaë sulcatifrons* having a diameter fifteen times those of the common soft-shelled crab, *Neptunus hastatus*.

We have a little fault to find with the present paper. The first is that which is found in all of the Fish Commission publications, but which here is not as bad as in embryological work—the use of process cuts. We notice a tendency to the creation of new families which hardly seems to be warranted. Until we know more of the morphology of the crustacean gill it hardly seems advisable to make gill-structure alone the basis of forming higher groups and separating widely species which are in all other respects closely allied.

Sedgwick and Wilson's Biology.[1]—We have several guides to laboratory work in biology, but the great fault with all is that they stick too closely to the anatomical and developmental sides

[1] *General Biology*. By William T. Sedgwick and Edmund B. Wilson. New York, H. Holt & Co. pp. vii + 193. 1886.

and almost entirely ignore the physiological aspect of animals and plants. A student has gained a valuable fact when he has learned the name and structure of any organ, but until he knows its function and the method in which it is performed his knowledge regarding it is incomplete. The present hand-book aims to teach the physiological as well as the morphological side, and thus fills a place which no other work in the English language does. It is, we understand, but a portion of what is intended, and this fact should be borne in mind in the following account. Still in its present condition it is admirably adapted for grounding students in biology. There are numerous exercises for the laboratory, and the directions for these are excellent; they tell the student what to do, but leave him to describe the results, thus giving the instructor a test of the student's progress.

The first three chapters are devoted to the phenomena of life and the study of organic matter, then follows a chapter on the cell, after which comes the study of special forms. Of these there are two, the fern—Pteris, and the earth-worm; and we agree with the authors in regarding these two forms as well adapted for study by the beginner as any. The book is well illustrated, most of the cuts being original, and though made by photo process they are usually clear and free from broken lines. A rather careful examination of the book reveals but little which calls for adverse criticism. On p. 123 it is stated that "all the organs of the body are originally developed from the walls of" the cœlom of the earth-worm, which is not true in the sense in which it will ordinarily be understood. Again one might criticise the use of "ectoblast" and "entoblast" (p. 178) for the inner and outer germ layers. Several other terms have priority, and it seems needless to multiply terms for each stage in the development of the organism. To be consistent the authors should replace the the term archenteron on p. 149 (not on 148) by mesenteron. The proof-reading has been very well done, and the typographical errors rare. The printer is, however, to be criticised, as he has used a badly worn font of type, and broken and battered letters are much too common. With the exception of these few points and a few of like character we have nothing but praise for the book.

Whitfield's Brachiopoda and Lamellibranchiata of New Jersey.[1]—This quarto volume is occupied with the Brachiopoda and Lamellibranchiata of the Raritan clays and greensand marls. Only three genera of Brachiopoda, Terebratula, Terebratulina and Terebratella, occur in New Jersey, and only two species, *Terebratula harlani* and *Terebratella plicata*, are at all abundant. The plastic clays, some of the layers of which yield large numbers of

[1] *Whitfield's Brachiopoda and Lamellibranchiata of the Raritan clays and greensand marls of New Jersey.* By R. J. Whitfield. T. L. Murphy, State printing office, Trenton, N. J.

plant remains, furnish five species of lamellibranchs, three of which are new. The lower marl beds are much richer, and from them Mr. Whitfield describes a new Pecten, an Amusium, a Camptonectes and a Modiola, besides founding two new genera. New species of Inoceramus, Civota, Axinea, Nucula, Nuculana, Trigonia, Gouldia, Lucina, Diceras and several other genera are also described. To the fauna of the middle marls are added a Gryphæa, two species of Idonearca and a Modiola; an Ostrea, a Modiola, a Cardita, two Crassatellæ and one species each of Criocardium, Petricola, Veleda, Caryatis and Periplomya are added to the beds at the base of the upper marls, while fifteen new species enrich that of the Eocene marls. The concluding chapter contains an account of the Unionidæ from the clays at Fish House, Camden county, two new species are described. There are thirty-five full-page illustrations and a map.

Recent Books and Pamphlets.

Prestwich, I.—On underground temperatures, etc. From the Proc. Roy. Soc. London, 1886.

——On the agency of water in volcanic eruptions. 1886. Both from the author.

Woodward, A. S.—On the relations of the mandibular and hyoid arches in a Cretaceous shark. Ext. P. Z. S., London, 1886. From the author.

Baur, G.—Ueber das Archipterygium und die Entwickelung des Cheiropterygium aus dem Ichthyopterygium.

——Ueber die Kanäle im Humerus der Amnioten. Both from the author.

Manigault, G. E.—The Black Whale captured in Charleston harbor Jan., 1880. Proc. Elliott Soc. From the author.

Frazer, P.—Report of the American Committee of the International Congress of Geologists. Ext. P. A. A. A. S., Aug., 1886. From the author.

Boettger, O.—Diagnoses Reptilium Novorum. Sep.-abd. a. d. Zool. Anz., No. 231, 1886.

—— Zur Kenntniss der Neritinen Chinas. Ext. Jahrb. d. Deut. Malak. Gess., 1886. Both from the author.

Marshall, W.—Ueber die Knöchernen Schädelhocker der Vögel. Haarlem, 1872. From the author.

Leche, W.—Ueber einige südbrasilianische Hesperomys-Arten. Sep.-abd. a. d. Zool. Jahrb., 1886. From the author.

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Minot, C. S.—Notes on histological technique. From the author.

Call, E., and Pilsbry, H. A.—On Pyrgulopsis, a new genus of Rissoid mollusk, with descriptions of two new forms. From E. Call.

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Hennessy, H.—On the fluid state of bodies composing our planetary system. Proc. Roy. Irish Acad., 1886. From the author.

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——On the development of osseous fishes. Ext. Ann. Rep. Com. Fish. and Fisheries, 1886.

——The development of the Mud-minnow, etc.

Ryder, J. A.—The development of Patella, etc.

——The early development of *Julus terrestris*, etc.

——The metamorphosis of the American lobster, etc. Amer. Nat. Extras, June, July, August, Sept.

——On the value of the fin-rays and their characteristics of development. Proc. U. S. Nat. Mus., 1886. All from the author.

Walker, H. D.—The gape-worm of fowls (*Syngamus trachealis*), the earth-worm its original host. Ext. Bull. Buff. Soc. Nat. Sci. From the author.

Crane, Miss A.—On a brachiopod of the genus Atretia, named in MS. by the late Dr. T. Davidson. P. Z. S., 1886. From the author.

Proc. Roy. Soc.—Obituary notice of Thomas Davidson, LL.D.

Eigenmann, C. H.—A review of the American Gasterosteidæ. Ext. Proc. P. A. N S., 1886. From the author.

Eigenmann, C. H., and Fordice, M. W.—A catalogue of the fishes of Beau Blossom creek, Merton county, Ind. Ext. idem. From the authors.

Woodward, A.—A new locality for *Haplophragmium cassis*, a rare Foraminifer. N. Y. Micros. Soc., 1886. From the author.

Gaudry, A.—Sur au bois de Renne, orné de gravures, decouvert à Montgaudier. Comptes Rendus, July, 1886.

——Sur l'Age de la Faune de Pikermi, du Léberon et de Maragha. Ext. Bull. d. l. Soc. Geol., 1886.

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Albrecht, P.—Epiphyses entre l'occipital et le sphénoïde chez l'homme.

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Evermann, B. W., and Meek, S. E.—A revision of the American species of the genus Gerres. P. A. N. S., 1886 From the author.

Hoernes, R.—Table des Matierés du Manuel de Paléontologie, traduit par L. Dollo. Librariè F. Savy. Paris. From the publisher.

Dollo, L.—Note sur les ligaments ossifiés des Dinosauriens de Bernissart. Ext. Arch. d. Biol., Gand, 1886.

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Shufeldt, R. W.—On injuries of the beak in birds, and methods of repair. Ext. Jour. Comp. Med., 1886. From the author.

Nat. Acad. Sci.—Report for the year 1885. Washington, 1886. From the department.

Ashburner, C. A., and Hill, F. A.—Report on the Bernice coal basin.

——Notes on the Mahoopany coal field.

Ashburner, C. A.—Borings for oil.

Lesley, J. P.—Pressure, quantity, composition and fuel value of rock-gas.

Carll, J. F.—Preliminary report on oil and gas. The last five, advanced copies from the Rep. Geol. Surv. Penna. From the survey.

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Dunwoody, H. H. C.—Monthly weather review, 1886. From the U. S. War Dept.

Selwyn, A. R. C.—Descriptive catalogue of a collection of the economic minerals of Canada. Colonial and Indian Exhibition, 1886. From the author.

Clarke, F. W.—Work done in the division of chemistry and physics 1884–5. Bull. U. S. Geol. Surv., No. 27.

Williams, G. H.—Gabbros and the associated Hornblende rocks. Bull. U. S. Geol. Surv., No. 28.

White, C. A.—Fresh-water Invertebrates of the N. American Jurassic. Bull. U. S. Geol. Surv., No. 29.

Cope, E. D.—The Origin of the Fittest. 8vo. D. Appleton &' Co. From the publisher.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

AMERICA.—*The Ruins of Copan, etc.*—A. P. Maudsley (Proc. Roy. Geog. Soc., Sept.) has a lengthy article upon the ruins and site of Quirigua and Copan, Central America, the result of explorations carried on in 1883 and 1884. At Quirigua the chief interest centers in thirteen large carved monoliths which seem to have once adorned one of the principal plazas of the Pueblo. These ruins are twenty-five to thirty miles northwest of Copan. The account gives the earliest authentic description of the ruins, that of Diego de Palacio, written in 1576. Mr. Maudsley maintains that almost all the so-called pyramids of Copan are the raised foundations which supported roofed buildings, probably temples; and that the long heaps of stones which have been taken for city walls are really the remains of single-chambered stone-roofed houses which were raised on foundations only a few feet high. The group of terraces which seem to have supported the principal edifices was cleared by the explorer, whose account is accompanied by plans and sketches. The largest mass occupies an area nearly equal to that of the great pyramid at Ghizeh, and is built of a rubble of rough blocks of stone and mud with binding internal walls of faced stone and cement, and an outer casing of well-worked stone, often elaborately sculptured. The stone casing is usually in great steps, some of which are eight feet in breadth and height. Although no roofed buildings now remain, stones cut to a bevel, such as would be suitable for the construction of horizontal arches like those of Tikal, were found. Our author maintains that Copan, Quirigua, Palenque, Tikal and the ruin on the river Usumacinta were abandoned before the Spanish discovery of America. Palacio's letter shows them to have been ruins in 1576, and proves that the Indians then living had no knowledge of the builders, and were themselves without skill to execute such works. Mr.

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

Maudsley describes the ruins of a town which he believes to have been the Chacujal of Cortez. Here the houses are of the same long and narrow form but were roofed with thatch, and are of inferior construction.

American News.—Up to August 27, fifty-three sheets of the general topographical atlas of the United States have been published. The forces of the Geological Survey are at work in Massachusetts, Northern Virginia, Central Arizona, and in the gold region around Oreville.——Two topographic parties and one hydrographic party are, according to "Science," at work on the re-survey of San Francisco bay. The Coast Survey is also at work on the transcontinental arc, with telegraphic longitude parties at Salt lake and Ogden.

EUROPE AND ASIA.—*Lake Leman.*—From a paper read by Professor Forel before the Association of Swiss Geographical Societies, it appears that there are two parts in Lake Leman, one small and shallow, the other large, deep and Alpine in its character. The two are separated by the Yvoise bank or bar, which is really a glacial moraine, as shown by the flints dredged up. Knowledge of the central portion of the lake is still very incomplete. The fragments of rock, sometimes brought up from a depth of sixty-one metres, are covered with moss of a beautiful green—a fact that seems to show that light penetrates to that depth. It has been discovered that the river Rhone flows in a sub-lacustrine ravine.

The Pamir.—The last issue of the Izvestia of the Russian Geographical Society contains a map of the upper course of the Amu-Daria between the 36th and 41st degrees of latitude, and the 66th and 76th degrees of longitude. The whole of the Pamir appears on this map according to the recent surveys and barometric levelings of the Pamir expedition, while a number of other surveys are taken into account.

M. Krendowsky (Memoirs Kharkuff Soc. of Naturalists) devotes a paper to the estuaries of the Bug, Dnieper, and other smaller ones in the neighborhood of Kherson and Odessa. He gives the character and geological history of these estuaries, which are now shut off from the sea by their sand-bars, and have become mere elongated salt lakes.

The Geographical and Statistical Dictionary of the Russian Empire, commenced more than twenty years ago, is just completed. Its great value, says Nature, is in the excellent geographical descriptions of the localities treated, including not only each separate government of Russia, Siberia, Turkestan and the Caucasus, but of the seas that border Russia, and of their islands. The geology, fauna and flora have also received much attention, and there is a complete bibliography. An appendix is promised, giving descriptions of regions such as the Thian-Shan, Ferganah, and Transbaikalia, which were much explored during the publication of the dictionary.

PACIFIC ISLANDS.—*Captain Bridges' Cruises.*—Captain C. Bridges' notes upon cruises among the Pacific islands (Proc. Roy. Geog. Soc., Sept.) give a good idea of the present condition of the islands visited. In the southern section of the New Hebrides the temperature ranges from 62° in July and August, to about 92° in January and February. The natives of Aneiteum are devout Christians. Among the Melanesians of these islands, communities of Polynesians preserve themselves distinct. The staple product is *copra*, the dried pulp of the coco-nut, and several white traders are engaged in procuring it. On Sandwich or Vaté, the women shave their heads completely, while on Espiritu-Santo they leave a ridge of hair from poll to forehead. The houses are neat and clean; on some islands the unmarried men sleep in a special house.

The people of the Solomon isles are good seamen. Their canoes, except as New Britain and New Ireland are approached, have no outriggers. The New Britain people go quite naked, and lack the vigor of the Solomon islanders. They are the only cannibals of the region who are not ashamed of their cannibalism. It is not etiquette in New Britain to ask a man his name, it should be asked of some one else. Captain Bridges mentions a curious mode of shark-catching practiced by the Kingsmill islanders. They tow from a canoe a large line with an open noose. Through the centre of the noose is passed a small line with a bait on the end. As the shark follows the bait, it is hauled in, until at last the fish has his head in the noose, which is quickly tightened. The people of the Ellice islands are all Episcopalian Christians, while those of the Gilbert islands are partly Christianized.

The Marshall island men are tall, the women singularly short. The dress of the latter consists of two ornamented mats tied around the hips so as to resemble somewhat a sleeveless and low-necked gown. On these islands and some of the Carolines the women tattoo the hand and fore-arm in such a way that they appear covered with open-worked mitts. The money of Yap (Carolines) is in the form of disks of arragonite, like great grindstones. They are quarried in the Pelew islands, and some pieces weigh three tons. The people of Nicguor and Greenwich islands, two low atolls of the Carolines, are almost gigantic, and are now ruled by queens. In the Pelew islands the younger men have large "club-houses." Women may not enter the club-house of their own village, but may without losing caste visit that of the next. The constitutional government of Tonga seems to be a success. Most of the Tongans are now fearless horsemen, though many can remember the time when there was not a horse in the Archipelago. The people of the Louisiades are in physique and knowledge of the arts inferior to both the light and dark races of S. E. New Guinea. The peculiarity of macrodontism, *i. e.*, the extension of one tooth over the space usually occupied by two or three, was noticed among the men of Rossel island. While in the south of New Guinea the natives are in the stone age, in the north they use shell implements.

The New Zealand Earthquake.—Dr. Hector's preliminary report upon the recent volcanic eruption in New Zealand enable some idea to be formed of the magnitude of this convulsion of nature. The outbreak commenced at half-past two on the morning of June 10th, by an eruption from the top of Wahănga, the northernmost summit of the Tarawera range. This was in a few minutes followed by a more violent outburst from the summit of Ruawahia, the central peak of the same range, and this was shortly afterwards followed by a terrific explosion from the south end of Tarawera itself. For two hours vast quantities of steam, pumice-dust and stones were poured out. A great crack or fissure was formed along the east face of the mountain, and Mr. Percy Smith reports that the whole east end was blown away, the débris covering the country for many miles. Up to this time the earthquake shocks which occurred were not very violent, but about 4 A. M. came a powerful earthshock, attendant on the outburst of an immense volume of steam from the site of Rotomahana lake. By 6 A. M. the period of active eruption had passed; but the town and vicinity of Wairoa were smothered in the mud condensed from the cloud of steam and solid matter thrown up from Rotomahana.

The formerly abrupt sides of Tarawera are now everywhere softened by great slope deposits of material ejected from a range of volcanic vents, seven of which were in a mild state of eruption when visited by Dr. Hector. From the south-western extremity of Mt. Tarawera a great fissure runs south-westward for some seven miles. The eastern side of this has a nearly straight wall, but the western is very irregular and is continually altered by the falling in of its walls as they are undermined by the action of seven powerful geysers which at irregular intervals throw up great volumes of boiling water, stones and mud to a height of 600 to 800 feet. Lake Rotomahana has disappeared in this chaos. The largest mud geyser occupies the site of the Pink terrace, another that of the White terrace. At its northern end this fissure commences in a great rent 2000 feet deep, 500 wide, and 300 deep on the side of Tarawera, and the southern end is a bold semicircular escarpment. No fissure or fault seems to continue beyond the depressed portion, which seems to be entirely due to the removal of material. One mud geyser, about a mile south of the Pink terrace, is on comparatively high ground, and has built up for itself a mound which was several hundred feet high a few days after the chief eruption.

All the fragments found seem to be of local rock, though eye witnesses state that they reached the ground in a partially incandescent state. Dr. Hector concludes the eruption to have been a purely hydro-thermal phenomenon on a gigantic scale, but quite local in character.

AFRICA.—*African News.*—Lieut. E. Gleerup, a Swede in the service of the Congo Free State, has recently crossed Africa from the Congo to Zanzibar. He had been left for nearly a year without supplies at the remote station at the seventh cataract of the Stanley falls, and finally left for Europe by the aid of funds furnished by Tippoo Sib, the rich Arab trader. The journey to the east coast occupied six months.——Reports by the late Sir P. Scratchley, British Special Commissioner to New Guinea, gives a description of the characteristics of the natives of different portions of the coast of British New Guinea. The littoral seems to be well inhabited, except some portions of the north-east coast. Two rivers, the Davadava and Hadava were discovered in Milne bay, the latter river a large one.——Dr. Paulitschke writes, in the Mittheilungen of the Geographical Society of Vienna, upon the two hydrographic problems of the Somali peninsula, that of the Upper Webi, and that of the Juba. He believes that we must seek the source of the Webi in one of the lakes of Gurage.

GEOLOGY AND PALÆONTOLOGY.

NOTICE OF GEOLOGICAL INVESTIGATIONS ALONG THE EASTERN SHORE OF LAKE CHAMPLAIN MADE BY PROFESSOR H. M. SEELY AND PREST. EZRA BRAINARD.—In this paper is announced the discovery of quite an extensive new fauna in limestones, apparently of the age of the Birdseye limestone of the New York series, near the mouth of the Otter creek, Lake Champlain, which is of much interest owing to the fact that only about fifteen species of fossils have hitherto been known from the formation. The new forms described in the paper from this one bed are fifteen in number, comprising one Brachiopod, six Gasteropods and nine Cephalopods. One of the Gasteropods has given reasons for the establishment of a new genus, Lophospira, with *Murchisonia bicincta* Hall, and *M. helicteres* Salter, as the types. The bed of limestone in question is associated in the vicinity with recognized Chazy, Birdseye and Black River limestones, and holds a position considerably above the Maclurea beds of the Chazy close by. A close comparison of the fossils shows a much nearer relation with the form of the Birdseye and Black River than with the Chazy; the known species being principally from the Birdseye. *Orthocras bilineatum* Hall, *Maclurea affinis* Billings and *M. logani* Murch., *Asaphus canalis* Conrad, *Bathyurus extans* Hall, *Harpes ottawaensis* Billings and *Illæma crassicauda* (Wahl.) Hall. The Asaphus is known in the Chazy as well as in the Birdseye, and the Harpes was described originally from the Trenton. About the specific identity of the latter there is yet some doubt.

Besides the fossils already mentioned, the paper also includes descriptions of another new genus of gasteropod—Calaurops (a shephed's crook), for a form collected in a bed some twenty-five or thirty feet below and just above the Maclurea bed, having the form of a Euomphalus in the inner coils, but afterward becoming deflected in a straight line to the extent of six inches. Also two Trilobites and a Cyrtoceras from the Birdseye of Isle La Motti.

Since the meeting at Buffalo and during the week previous, the author of the paper, in conjunction with the persons named in the title of the paper, have made other collections at the same locality, which has resulted in the discovery and determination of several other species, the descriptions of which are nearly ready for the press, and illustrations of them for the engraver. The fauna of the Birdseye limestone at that locality is known now to consist of the following group of fossils:

Genus Orthis	1	species,	resembling O. perveta Con.
Streptorhynchus	1	"	new.
Leptæna	1	"	"
Triplesia ?	1	"	?
Maclurea	2	"	affinis and logani.
Euomphalus	1	"	new.
Helicotoma ?	1	"	"
Holopea	2	"	"
Subulites ?	1	"	"
Murchisonia	2	"	"
"	1	"	gracilis Hall ?
Lophospira	1	"	new.
Clisospira	1	"	"
Ecculiomphalus	1	"	"
Tryblidium ? or a new genus,	3	species,	new.
Bellerophon	1	species,	new.
Orthoceras	2	"	"
"	1	"	bilineatum Hall.
"	1	"	?
Piloceras	1	"	new.
Gomphoceras	2	"	"
Cyrtoceras	2	"	"
Nautilus	2	"	"
Lituites	3	"	"

Crustacea:

Genus Ribiera 1 species, new.
Asaphus canalis Conrad.
Bathyurus extans Hall.
Harpes ottawaensis Billings ?
Amphion 1 species, new.

Giving a total of forty recognized species in a condition suitable for description and illustration, of which the new ones are shortly to appear in a Bulletin of the Am. Mus. Natural History, with a description of the geology of the region by Professors Seely and Brainard.—*R. P. Whitfield.*

THE VEINS OF SOUTHWESTERN COLORADO.[1]—It is quite impossible to thoroughly understand the complicated vein-structure of the San Juan region without an intimate knowledge of the geological history. The details of the stratigraphy are very interesting, but we cannot stop to review them here. Suffice it to say that the succession of the strata, aside from local features of little importance for our present purpose, is much the same as in typical sections from the Rocky mountains through Wyoming and Northern Colorado.

The real vein-history begins with the close of the Cretaceous age, when the great folds took place which afterwards became the seat of volcanic action. I must refer to the previous papers read at this meeting of the Association for much of what might properly be brought into discussion here, and we may at once proceed to a brief description of the veins and their arrangement.

In the period of the andesitic outflows the country comprising the great San Juan Central area was so situated that the lavas did not cover it, and much of this material did not reach the surface, but it was forced in between the limestone and other rocks as intrusive masses. The general course of the fissures was along the primary longitudinal folds (N. 18° E.), and the veins were produced in fault crevices. Owing to the greater age of the deposits and their frequent intrusive character, there is considerable variety in the mineral contents and in the cross-sections of the veins. The earliest appear to be those of the La Plata district, with those of the Rico tract and the Summit district originating, perhaps, somewhat later. The first named are characterized by the abundance of gold, both free and in tellurides and similar compounds; the Rico area is peculiar from its close relationship to the Carboniferous limestones, resulting in the formation of carbonated ores, though in other respects this belt is very near the La Plata tract in its genesis; the Summit district is widely separated from these two basins, and has been the seat of much secondary action, so that the date of its initial stages in vein-formation is difficult to determine, but with results similar to those of the latest epoch. I am strongly of the opinion that the genesis was but little, if any, later than that of the other two sets.

In the Central San Juan area the complexity is very great, and yet the distribution of the veins may be brought into order in a beautiful system with surprising regularity in the grouping. There are six radial zones passing out from Red peak (the geyser

[1] Paper read before Section E, A. A. A. S., Buffalo, 1886.

basin described at the Buffalo meeting in another paper) and extending as far as the confines of a depressed area which was caused by faulting in the trachytic period. These zones are traversed by central, nearly vertical veins ("*parent fissures*," as I have elsewhere styled them), bounded upon each side by veins converging laterally and from above downwards. The mid-ribs are free-gold bearing, and they represent three trends intersecting near Red peak. These trends are about N. 80° E., N. 38° E. and N. 38° W. The zones vary in width, but between each two there is a barren belt of greater or less breadth. Beginning at the north we have (1) the *arsenical* zone, characterized by minerals carrying high percentages of arsenic; (2) the *bismuth* zone; (3) the *galena-gray copper* zone; (4) the *antimonial* zone, practically the prolongation south-westward of the arsenical wedge; (5) the *argentiferous-galena* zone, opposite the bismuth wedge, and (6) the *sulphuret* zone, a wide area with few veins, but these rich and carrying true silver minerals (sulphides) largely.

The faults and the vein-filling appear to have occurred subsequently to the trachytic ejections but prior to the rhyolitic period. The evidence is that the gradual elevation of the Red peak focus caused the subsidence and faulting along the edges and across two of the three stated radii of the depressed area, but that the deposition of the veins along the arsenical-antimonial trend was later than the rhyolitic period, or in its closing stages. After this the veins of the Red Mountain area were much modified by the secondary action of hot springs and geysers.

I have given here the mere outline of the facts, and but a small part of what has been put into other publications, but minute details can not be presented in this place.

It is, however, important to note that much material has been collected bearing more or less directly upon the source of the vein-stuff, and that the conclusion is imperative that local segregation from the volcanic rocks is wholly untenable. The idea that the veins in the volcanics have been derived from preëxisting ore-deposits in the subjacent metamorphics is quite as wide of the facts, and there can be no doubt of the deep-seated origin of the lodes at a period coincident with the igneous action.—*T. B. Comstock.*

A GIANT ARMADILLO FROM THE MIOCENE OF KANSAS.—The museum of the University of Kansas, at Lawrence, contains a portion of the dermal skeleton of an armadillo, probably of the family Glyptodontidæ, from the Loup Fork formation of that State. I owe the opportunity of examining and describing it to my friend, Professor Francis Snow, of that institution. The species appears to belong to a genus distinct from those known to belong to the Glyptodontidæ, which I shall call Caryoderma. Its peculiarity consists in the fact that a portion of the carapace is represented by osseous nuclei only, which do not articulate with each other. The scuta belonging to the tail are distinct from each other, and not coössified as in Dædicurus. The species may be named and described as follows:

Caryoderma snovianum Cope, sp. nov.—The dermal scuta may be arranged in four classes. First, the smallest, which are subquadrate in outline, and flat; one of the flat faces, probably the internal, smaller than the opposite one, and more spongy. Six of these; the largest 15^{mm} in width. Second, larger scuta, subhexagonal or pentagonal, or oval, with the dense smooth external face rising towards and produced beyond one of the borders of the base as a flat more or less angular cornice. This cornice is separated from the border of the basal part of the bone by a rabbet or open groove. Inferior surface perforated by foramina. Edges finely rugose. Of this type there are seven scuta. Dimensions of largest, length 32^{mm}, width 35^{mm}. The third type resembles the second, but the cornice is represented by a conical elevation which does not project beyond the edge of the base, but stands above or within it. Inferior surface more or less concave. Size of largest, length 40^{mm}, width 33^{mm}; of smallest, 15^{mm} by 14^{mm}. Four large and three small. The fourth kind of dermal bone is an acute cone with a small convex base, more or less obliquely truncated. Four of these, two large and two small. Measurements of former, base 28^{mm} by 22^{mm}, total elevation 32^{mm}; measurement of smaller kind, base 15^{mm} by 11^{mm}, total elevation 22^{mm}.

It is probable that the third kind of plate belongs to the tail, where they enter into the composition of the annuli, as in Glyptodon and Hoplophorus. Processes resembling the fourth kind are found on the superior middle line of the tail in Hoplophorus, and also along the inferior edge of the carapace.

An ungual phalange is of interesting form. It is hoof-like, longer than wide, and squarely truncate at the extremity without notch. The superior surface is convex in transverse section, and straight in profile, which rises behind. The inferior face is flat for the distal two-thirds; the proximal two-thirds rising to the articular surface. The latter is not wider than the distal extremity, the surface expanding and forming a shoulder one-quarter the length distad of it. Articular surface concave vertically, a little convex transversely. Total length of phalange 32^{mm}, greatest width 24^{mm}, greatest depth 17^{mm}; width of extremity 14^{mm}; of articular facet 15^{mm}.

The discovery of this form in the Loup Fork bed of Kansas is of much interest on several accounts. First, it is the first time this group of Edentata has been discovered north of the valley of Mexico. Secondly, as belonging to an earlier epoch than the Pampean Glyptodontidæ of South America, Caryoderma stands in the position of ancestor. Thirdly, the rudimental character of some of the segments of the carapace shows the latter to have been undeveloped, which is further consistent with a relation ancestral to the other armadillos. It is probably a case of persistence, however, for since the Miocene beds of the Parana have been shown by Ameghino to contain ancestral Glyptodontidæ, the North American ancestors of these are to be sought in beds earlier than the Loup Fork. The species was discovered by Mr. Charles H. Sternberg, in Northern Kansas. It is respectfully dedicated to Professor F. H. Snow, of the university of that State.

GEOLOGICAL NEWS.—*General.*—In these days of earthquake theories that of M. De Montessus (Rev. Scient., 1886, 369) is worthy of notice. He starts by enumerating the three chief theories of the constitution of the earth: (1) A central fluid nucleus with a more or less thick crust; (2) a central solid nucleus and a solid crust separated by a spherical liquid ring; (3) a solid interior with chambers filled with fluid. Postulating the correctness of the first theory, which prevails in France and holds its own in other countries, he then gives, as the result of calculations made upon 4943 shocks, the statement that earthquakes are more frequent when the moon is on the meridian than when it is at right angles with it. From this he passes to the fact that were the ocean composed of a dense fluid, like mercury, the tides would consist of an actual transport of matter following the moon's course. May not such tides take place below the earth's crust? Capt. Boulanger, in 1880, dared to doubt that the earth moved as a whole, so that the velocity of every point is proportional to its distance from the center. The patient study of the sun spots has proved that there is in the sun's matter an internal and external circulation quite different from that which would result from a rotation in every point proportionate to the radius. Vortex motions, according to M. Faye's law, must be produced in fluids the layers of which are in movement with slightly differing velocities. Add these vortex movements to the subterranean lunar tides, and M. Montessus' earthquake theory is outlined.

Palæozoic.—Professor Ed. Hull, Mr. Mellard Reade and others in Britain, with Mr. Crosby in America, maintain that in Palæozoic times the North Atlantic and the North American continent in the main changed places. In the words of the first of these: "If it be allowed as a general principle that the originating lands lay in the direction towards which the sediments thicken, and opposite to that in which the limestones are most developed, the conclusion is inevitable that the Atlantic was, in the main, a land surface in Palæozoic times."

Permian.—M. Alb. Gaudry describes *Haplodus baylei*, a reptile from the Permian beds of Telots, near Autun (France). The name is derived from Greek words which signify the close adhesion of the teeth to the maxillaries. Three other types of reptiles, Actinodon, Protriton and Stereorachis, are now known from these beds.

Secondary.—The central region of Tunis, according to M. Rolland, consists in great part of a mass of senonian beds with limestones yielding inocerami and cephalopods. This mass is here and there capped by nummulitic beds. These beds are found all around the Mediterranean region, but those of Algiers and Tunis are characterized by peculiar species.——M. Thomas has discovered beds of phosphate of lime in Tunis. In the south-west are rich and very extensive Eocene deposits, while near Feriana there is a small bed of Cretaceous age. In the Albian marls of Constantine, in Algeria, there are notable Cretaceous beds of this mineral.

Quaternary.—M. Reviere, who at the meeting of the French Assoc. Adv. Sci. at Grenoble, in 1885, gave a list of 171 shells discovered in the grottoes of Meudon, has this year described the fishes and birds. The few fishes found are principally those of fresh water, which seems inexplicable among peoples living on the shore of a sea so rich in fishes as the Mediterranean. The vertebra of a salmon, a fish of the northern rivers, was found, and speaks of the migrations of these Quaternary peoples.

MINERALOGY AND PETROGRAPHY.[1]

NEW BOOKS.—The third part of Professor von Gümbel's "Geologie von Bayern"[2] has just been received. Although not yet completed, enough of the first volume has already appeared to show that the work in its entirety will fill a long felt want. In this volume the author proposes to set forth the principles of geology as generally accepted at the present time, devoting quite a considerable portion of the book to the microscopical characteristics of rocks, and to the truths which the microscope reveals, as well as to the theories to which the use of this instrument has given rise. That portion of the book which has already appeared is well illustrated by nearly four hundred photo-engravings. Most of these illustrations are taken from localities in Bavaria. The author, however, has not hesitated to draw on any source that would serve his purposes better than those at hand in his own country. The result is a most satisfactory text-book of geology, in which all the most modern methods of geological research are described, and the results to which each leads carefully given. The subject of metamorphism has received considerable attention and also the theories relating to "petrogenesis," or the origin of rocks. The second volume will be devoted to a description of the geology of Bavaria.——The first of a series of monographs on edu-

[1] Edited by Dr. W. S. BAYLEY, Madison, Wisconsin.

[2] Geologie von Bayern. Bd. I, Lief, I, II, III, Grundzüge der Geologie. Dr. K. W. von Gümbel. Cassel, 1884-6.

cation has recently been published by Heath & Co., of Boston.[1] It is a neat little book of thirty-five pages, intended primarily to call the attention of teachers to the rise and development of the youngest branch of geological science, and to the methods which are made use of in it. A very large amount of information relating to the history of petrography is embraced within the first twenty-five pages of this little volume. The next five pages contain a list of the most important works devoted to the subject and the periodicals in which petrographical articles are published. In the remaining pages the methods made use of in the preparation of thin sections are described and the names of reliable dealers in the instruments and materials used, with the cost of these, given.

MINERALOGICAL NEWS.—Ptilolite[2] is a new mineral, described by Cross and Eakins, from Colorado. It occurs in the cavities of a vesicular augite-andesite found as fragments in the conglomerates of Green and Table mountains, in Jefferson county. It forms delicate tufts and spongy masses composed of short hair-like needles which are usually deposited upon chalcedony in the pores of the rock. Under the microscope these needles are seen to be colorless, transparent prisms about $.001^{mm}$ in diameter, terminated by a basal plane. Their extinction is parallel to the prismatic axis. An analysis of the purified material yielded Mr. Eakins the following result:

SiO_2	Al_2O_3	CaO	K_2O	Na_2O	H_2O
70.35	11.90	3.87	2.83	0.77	10.18

This corresponds to the formula $Ro\ Al_2O_3,\ 10SiO_2 + 5H_2O$. The mineral is interesting as being the hydrated form of the most acid anhydride known among the silicates, with the exception of the rare mineral milarite.——A pseudomorph of limonite after pyrite[3] recently found in Baltimore county, Maryland, contains six of the seven possible crystallographic forms of the regular system. The forms actually observed are O, $\infty O\infty$, $\left[\frac{\infty O2}{2}\right]$, $\left[\frac{4O2}{2}\right]$, 2O2, and 3O. The fact that only two planes of the forms $\left[\frac{4O2}{2}\right]$, 2O2, and 3O are developed in each octant imparts to the crystal an orthorhombic symmetry.——The turquoise from Los Cerillos, New Mexico, has been studied chemically and microscopically by Messrs. Clark and Diller,[4] of the United States Geological Survey. It occurs imbedded in a fine-grained red orthoclase rock with a microgranitic structure, sometimes in

[1] Modern Petrography. An account of the application of the microscope to the study of Geology, by G. H. Williams, 1886.

[2] Whitman Cross and L. G. Eakins. Amer. Jour. Sci., XXXII., Aug., 1886, p. 117.

[3] On a remarkable crystal of pyrite from Baltimore county, Md. Geo. H. Williams. Johns Hopkins Univ. Circulars, No. 52, 1886.

[4] Amer. Jour. Sci., XXXII., Sep., 1886, p. 211.

nodules, but more frequently in seams and veins. In color it ranges from sky-blue, through greenish-blue, to dark-green. Analyses of specimens of these three varieties yielded:

	Bright blue.	Greenish blue.	Dark green.
H_2O	19.80	19.60	18.49
Al_2O_3	39.53	36.88	37.88
Fe_2O_3		2.40	4.07
P_2O_5	31.96	32.86	28.63
CuO	6.30	7.51	6.56
SiO_2	1.15	.16	4.20
CaO	.13	.38	

Upon comparing these results with those obtained by other investigators, the authors conclude that normal turquoise can be represented by the formula $Al_2 HPO_4 (OH)_4$. The various colors which it possesses are probably due to the admixture of a copper molecule $2CuO\ P_2O_5\ 4H_2O$. The presence of iron salts would tend to give a greenish tinge to the mineral. Under the microscope it was seen to be composed of minute grains or short thick fibers, weakly doubly refracting, with a high refractive index. The extinction was parallel to the long axes of the fibers. A consideration of the arrangement of the fibers in the veins, the composition of the rock in which the mineral is found, and its association with epidote, lead the authors to the supposition that it may have been derived from apatite.[1]

Petrographical News.—The gabbros occurring near Baltimore, and the hornblende rocks associated with them have been made the subject of a bulletin of the U. S. Geological Survey.[2] The treatment of these rocks by the author is very thorough. The paper opens with an introduction calling attention to the fact that eruptive rocks may, under the influence of heat and pressure, become schistose and in their characteristics very like the crystalline schists which have been derived by the alteration of aqueous formations. The main portion of the work is devoted to the tracing of hypersthene gabbro into a schistose rock, called by the author gabbro-diorite. The massive gabbro consist essentially of a fine to coarse grained mixture of bytownite, light-green diallage and hypersthene in varying proportions. In addition to these there are also contained in the gabbro a little yellowish-brown hornblende, strongly pleochroic and full of minute black inclusions,[3] some magnetite and in a few instances considerable apatite. By alteration of the diallage and hypersthene into a fibrous hornblende the gabbro passes gradually into a schistose rock, containing in addition to the plagioclase and hornblende a considerable amount of epidote and some garnet, apatite, rutile, sphene, etc. In the case of the alteration of hypersthene the author supposes a reaction to have taken place between this

[1] Cf. American Naturalist, January, 1886, p. 61.
[2] Dr. G. H. Williams, Bulletin of the U. S. Geol. Survey, No. 28.
[3] Cf. American Naturalist Notes, March, 1886, p. 275.

mineral and the feldspar of the rock, the latter supplying the former with the necessary aluminum required to build up the hornblende molecule. In addition to the two rocks mentioned, there are in the same region olivine-bronzite-gabbros, feldspathic peridotites and lherzolites. In some of these rocks the feldspar has undergone a rather unusual alteration, viz., into scolecite. Other rocks, composed entirely of bronzite or hypersthene with or without diallage, are mentioned and briefly described. These olivine and pyroxenic rocks have given rise to much of the serpentine so generally found in their neighborhood.——In the August number of the American Journal of Science, Mr. J. S. Diller[1] has an article on the peridotite of Elliott county, Kentucky. This rock, according to the author, occurs in well-marked dykes cutting Carboniferous sandstones and shales. A microscopic examination shows it to consist of olivine and pyrope, with a small amount of ilmenite as primary constituents, and serpentine, dolomite, magnetite and octahedrite as secondary minerals. The interesting fact is noted that around the garnet a reactionary rim exists analogous to the kelyphite[2] of Schrauf. Instead of amphibole, however, the fibrous mineral in the rim is biotite. From a comparison of the composition of the peridotite and the intersected sandstones and shales and the discovery of both endomorphous and exomorphous changes (mica and spilosite in the shales, and a variolitic structure in the peridotite) in the neighborhood of their contact, the author concludes that the peridotite is without doubt an intrusive mass and eruptive in its origin.——Mr. Geo. F. Becker[3] has replied to the article of Messrs. Hague and Iddings[4] on crystallization in the igneous rocks of the Washoe district. The author of the present paper denies the validity of many of the results of Messrs. Hague and Iddings, and claims that a second visit to the Washoe region and a reëxamination of the rocks collected there have established him firmly in the belief that the granitoid and the glassy rocks are of entirely distinct eruptions, which took place at two different periods remote from each other, and that in many cases minute differences of chemical composition have produced effects greater than moderate differences in the depths at which the rocks cooled. He moreover claims that a mere study of the slides and hand specimens is not sufficient to overthrow his own theory of the succession of rocks in the vicinity of the Comstock lode.——Professor R. D. Irving, of the United States Geological Survey, in an article in the American Journal of Science,[5] maintains that the iron ores and the associated jaspery schists of the Lake Supe-

[1] Amer. Jour. Sci. XXXII, Aug., '86, p. 122.
[2] Cf. AMERICAN NATURALIST Notes, Feb., 1886, p. 161.
[3] Bulletin 6, California Academy of Sciences, p. 93.
[4] Cf. AMERICAN NATURALIST Notes, Dec., 1885, p. 1216.
[5] Origin of the ferruginous schists and iron ores of the Lake Superior region. Amer. Jour. Sci., XXXII., Oct., '86, p. 255.

rior region were derived from an original iron carbonate which was interbedded with carbonaceous shales which were themselves often impregnated with the same mineral. By a process of silicification these carbonate-bearing layers were transformed into the various kinds of ferruginous rocks now met with in this region. In some cases silicifying waters decomposed the iron carbonate in place, producing tremolite or actinolite and magnetite, which with the excess of silica remaining formed the actinolitic schists so frequently found associated with the iron ores. In other cases direct oxidation of the carbonate gave rise to bodies of hematite. In still other cases during the silicification of the rocks and the decomposition of the carbonate, the iron was removed by leaching and deposited in other places as it became oxidized. The jasper is supposed to be secondary and to have been deposited upon the removal of the iron carbonate in the process of silicification. The various theories which have heretofore been put forward to account for these interbedded iron and jasper layers are all in turn examined and pronounced insufficient to explain the phenomena met with everywhere in the study of the region.

BOTANY.[1]

The Wind and the Tree-tops.—Since 1875 the writer has observed, in various parts of the country, 156 instances of injury to the trunks or branches of trees by wind.

Of all ordinary trees the common red maple appears to suffer most in hard winds, and the whole 156 observed cases of injury were confined to the various species of deciduous trees. The writer has seen hundreds of long-leaf pines in Georgia and Florida that had been blown up by the roots, but not one injured in trunk or branch while the tree was yet standing. Also close inquiry in Iowa and a whole summer's observation among the white pines of Tennessee failed to reveal a single case in which a tree of that species was injured by the wind. Of the 156 observed instances of injury sixty-one per cent were limbs split off at the crotch.

The crotches of a tree are its weak points. Nature recognizes this fact and guards against the weakness by swelling out the wood about the points of branching. Notably is this true of the white pine. In a large tree of this species the limbs come out in regular whorls about two feet apart. Midway between each two successive whorls the central axis of the tree has a minimum size. Above and below this point of least circumference the trunk gradually swells out to support the successive sets of branches.

In sixty per cent of the observed injuries the trunk divided into two or more large nearly equal branches, and one of these

[1] Edited by Professor Charles E. Bessey, Lincoln, Nebraska.

was the injured member. These large limbs, swaying in a hard wind, act as great levers, and are frequently not sufficiently supported at the crotch.

The meaning of all this is that a tree of which the trunk habitually divides into large nearly equal branches is much more liable to be injured by the wind than one having a strong central axis with many small limbs as, for example, the white pine.

Thus the accumulated effects of the wind have undoubtedly been to develop excurrent forms of tree-top. But the question naturally arises why pines, spruces, etc., have this form in greater perfection than other trees. Well, in the first place deciduous trees are usually injured by the wind only while in foliage during the summer months; but evergreens, being always in foliage, are practically exposed to the action of the wind for at least twice as great a time each year as are maples, elms, etc. Then too, according to palæontology, the cone-bearing evergreens came into existence many thousands, perhaps millions, of years before any tree that annually sheds its leaves. Thus the coniferous evergreens have had a vastly longer time in which to accumulate the effects of the wind and develop an excurrent form of top than have deciduous trees.—*B. F. Hoyt, Manchester, Iowa.*

A Hybrid Apple.—Recently a student brought me a "Ben Davis" apple characteristically marked throughout a little less than three-fourths of its surface, the remainder (a wide crimson streak from stem to calyx) having undoubted marks of the "Jonathan" variety. The tree from which it came is a "Ben Davis," and a "Jonathan" tree stands within a distance of several rods. Upon cutting the apple it was found that the hybridization was confined to two carpels, and that the development of the flesh of these and the corresponding calyx-segments had been somewhat greater longitudinally and considerably less transversely than for the remaining carpels. Upon tasting the flesh of the "Jonathan" part of the apple it was found to differ quite perceptibly from that of the "Ben Davis" part.

It is probable that we have in this apple an example of the immediate effect of the pollen upon the fruit. In this case the "Jonathan" pollen affected the fruit (a) by changing the color of the skin, (b) by causing the hybrid segments to grow longer and narrower, thus approximating nearer to the "Jonathan" form, and (c) by changing the taste of the flesh.—*Charles E. Bessey.*

Ruppia maritima L. in Nebraska.—This maritime plant has lately been brought to me from a pond near one of the many salt springs which occur in the vicinity of Lincoln. The species is not recorded in the catalogues of the Western State floras, viz., Minnesota (Upham), Iowa (Arthur), Missouri (Tracy), Kansas (Carruth); nor does it occur in the East, away from the seaside, with but a single exception. It is not found in the flora of Indiana (Coulter and Barnes), Cincinnati (James), Michigan (Wheeler and Smith), Ohio (Beardslee) Buffalo (Day), Cayuga, N. Y. (Dudley), nor even of Washington, D. C. (Ward).* It was discovered many years ago in Oneida county, N. Y., by Paine, who says of it: "This plant and its companion [*Naias major*] are new to the interior, having been known hitherto as exclusively maritime" (Eighteenth Ann. Rep. of the Regents of the Univ. of the State of New York on the State Cabinet of Nat. Hist., p. 133).

In Frank Tweedy's "Flora of the Yellowstone National Park," *Ruppia maritima* is said to be "common in the sluggish streams and water-holes of the hot-spring and geyser areas" (p. 66), and elsewhere (p. 20) the statement is made that it "has been observed in situations where the water had a temperature of 90° Fahrenheit."

The occurrence of this little plant in these widely separated localities is, to say the least, very interesting. From the sea-coast to the Oneida county, N. Y., station is fully 150 miles, thence to the Nebraska station is 1100 miles, and from the latter point to the National park is 700 miles. The distance from the Nebraska station to the Gulf of Mexico is about 800 miles.—*Charles E. Bessey.*

THE ROUGHNESS OF CERTAIN UREDOSPORES.—Recently while examining the uredospores of *Puccinia coronata*, a common rust of the oat, a student in my laboratory complained of the difficulty he had in making out the prickly (*stachlig*) surface of the spore-wall. The spores had been mounted in water in the usual way, and it was with the utmost difficulty that any roughness of the surface could be made out, and when made out it was so faint as to warrant the remark that "a character so difficult to be observed and so likely to be overlooked should not be made use of in descriptions." The spores, in fact, appeared in most positions to be perfectly smooth. The suggestion was made to examine them *mounted dry*, when lo! the prickles appeared with the greatest distinctness. This hint may be worth remembering in much of our work in botanical laboratories.—*Charles E. Bessey.*

ANOTHER "TUMBLE-WEED."—While riding through Phelps and Kearney counties, in South-central Nebraska, my attention was called to great masses of some much-branched, white-woolly plant which occupied the ditches by the side of the railway. Its appearance was so odd and so different from anything I had ever seen that I could not conceive what it could be. A fortunate stop of the train outside the limits of a town allowed me to secure specimens, which upon examination proved to be *Psoralea tenuiflora* Pursh. The leaves had fallen and the naked branches, in drying, had diverged still more than in life, giving to the plant an appearance quite different from that which it bears when growing. The mode of detachment is the usual one of the formation of a joint at one of the lower internodes. In some cases two such joints were observed. The break at the joint is smooth and even, and reminds one of the separation of a leaf from its twig.

It may be well to say that the plant under consideration is densely silky woolly in every part excepting its principal s'ems. It is certainly not "minutely hoary pubescent when young," as described in the manuals (Gray, Man., p. 129; Coulter, Man., p. 56). On account of the loss of leaves it is impossible to determine whether this may not be the variety *obtusiloba* of Watson (Bib. Index N. A. Bot., p. 255). If so this is a much more northerly range than this variety of the species was supposed to possess. In all cases but one the variety is said to be a native of Texas. Creutzfeldt collected it in "Kansas" in 1853 (Pacific Railroad Report, 2, p. 126), and from the date of its collection (June) it must have been found in Eastern Kansas. Carruth, however, does not record it in his catalogue of Kansas plants (Trans. Kan. Academy of Sciences, Vol. v).—*Charles E. Bessey.*

Botanical News.—The October Journal of Botany contains a paper, by Baron F. von Mueller, on "New Vacciniaceæ from New Guinea." A new genus is described under the name Catanthera. It contains one species, *C. lysipetala* Mueller, which appears to have affinities with Oxycoccus, though strangely it shows relationship alwish the toClethreæ and Pyrolaceæ. It is an epiphyte.——In the same journal James Britten contributes an article on "The nomenclature of some Proteaceæ," in which the question of priority of Salisbury's names in the Proteads and other groups of plants is discussed. He says: "I am of opinion that there was a tacit understanding on the part of the botanical leaders of the period, including Brown, Banks and Smith, that Salisbury's work and names should, as far as possible, be ignored, not only on account of their strong antipathy to the man himself, but also, in Smith's case at least, to the views of classification which Salisbury promulgated;" an outrageous proceeding if true, as it appears to be.——Dr. Newberry gives additional reasons, in the October Torrey Bulletin, for regarding *Pinus monophylla* as but a variety of *P. edulis*. He says: "In the Rocky mountains all are two-leaved; in some arid portions of Nevada the tree is dwarfed to half its normal size, and all the leaves are single. Midway between these districts, in Southern Utah, may be found thousands of trees in which the leaves are half double, half single."——Dr. Gray's Memorandum of a revision of the N. A. violets, in the Botanical Gazette, indicates certain interesting changes of arrangement and nomenclature. *Viola delphinifolia* Nutt. becomes *V. pedatifera* Don.; *V. cucullata* Ait. var. *palmata* becomes *V. palmata* L., while *V. cucullata* Ait. is considered to be "an entire-leaved variety of the Linnæan *V. palmata*." The suggestion that

V. pedatifida Don. is "probably only a marked geographical variety of that species [*V. palmata* L.] with all the leaves finely dissected," is worthy of further attention. In the Mississippi valley, where the three forms all grow, often quite near one another, their relations could be well expressed by considering *V. pedatifera* one extreme and *V. cucullata* the other, with *V. palmata* as an intermediate form. However, it will not do to consider the intermediate form, which is far less common than the others, as the type of the species. It is simply an intermediate form, and not a very constant one either.——L. H. Bailey's Preliminary synopsis of N. A. Carices (Proc. Am. Ac. Arts and Sciences) came to hand late in October. It contains notices of 289 species including, in addition to the strictly North American species, those of Mexico, Central America and Greenland.

ENTOMOLOGY.

A Remarkable Case of Longevity in a Longicorn Beetle (Eburia quadrigeminata).—On the 11th of July, 1886, I caught at sugar, which had been placed upon apple trees for the purpose of attracting moths, a light brown long-horned beetle, marked with ivory yellow spots on the elytra. My attention was particularly attracted at this time to the insect on account of a peculiar creaking sound which it began as soon as I picked it up. I had no difficulty in finding that the sound was produced by the rubbing of the posterior margin of the prothorax upon the anterior margin of the mesothorax. The same sound could be made after the insect was dead, by working backward and forward its head and prothorax. Several days after this occurrence I captured a specimen, similar to the first, upon the clothes of a friend, but it disappeared before I reached home. On the 17th of July I found a third specimen on a tree but a few feet distant from that upon which I discovered the first specimen; this individual was also evidently attracted by the sugar. Five days later, July 22, 1886, another specimen came into my posession under much more remarkable circumstances. Dr. Boyd, of Dublin, Wayne county, Ind., called my attention as I was walking along the street, and at once proceeded to remove two small corks with which he had closed two openings in the door-sill of his office. He then requested me to explain what had made the tunnels that evidently extended some distance into the sill. In reply to my questions, he stated that his attention had been called to the freshly made openings early in the morning; at that time the holes were much smaller, and were ragged around the edges. These rough edges he had smoothed with a knife so he could stop them tightly with corks. A short time after he made the discovery mentioned, his attention was attracted by a buzzing noise which came from one of the tunnels. This he put an end to by pouring chloroform into the opening, and then plugging it up with a cork. There had been no sound of life from the other tunnel, but he had closed it in the same manner. Upon hearing this I removed the cork from the tunnel where the sound had been heard, and in a moment dragged out by its antennæ a beetle, similar to those whose finding I have already described. This beetle is *Eburia quadrigeminata* Say.

Mr. Thomas, in the "Sixth Report of the Illinois State Entomologist" describes the imago as follows: *Eburia quadrigeminata*, "Body, entirely pale yellowish-brown; antennæ hardly more obviously hairy on the basal joints than on the others; thorax, with two black tubercles above, rather before the middle, placed transversely, and a short spine each side on the middle of the length of the thorax; elytra, rather paler than thorax, each with two double, somewhat elevated, bright-yellow, abbreviated very short lines; the two members of the basal spot equal, the other spot is placed on the *middle*, the inner member is shorter than the exterior one; tip, two spined, the exterior spine the longest; intermediate and posterior thighs, two spined at tip, the inner spine rather longest." Mr. Thomas also states that the insect is from three-fourths to an inch in length, and that its larva lives and bores in the honey locust (*Gleditschia triacanthus* Linn), and from this fact it gets its name of the honey locust borer.

A closer examination of the tunnels in Dr. Boyd's doorstep showed that the external openings were in the middle of the length and breadth of an ash door-sill and about four inches distant from each other. The size of the tunnels increased rapidly within until the diameter was three or more times as great as at the exit. They extended downward and backward respectively three and four inches. The sill was of painted ash and it, as well as the whole building, rested directly upon a solid brick foundation. After having completed the above observations, I did not hesitate long in coming to the conclusion that the eggs which had produced this beetle and its fellow, that had made good its escape, were laid in the green wood in the tree. In response to my questions, Dr. Boyd made the statement that the building was erected in the Spring of 1867. This would make these insects not less than nineteen, and probably twenty or more, years old, since the timber was dry when put into the house. Upon investigation I find that Professor Packard in his "Insects Injurious to Forest and Shade Trees," makes no mention of this beetle, but that he has recorded two cases of unusual longevity in beetles which will be of interest in this connection. In both instances these beetles have belonged to the family Cerambycidæ or longicorns. The first mentioned case was that of a specimen of *Monohammus confusor* Kirby, the common longicorn pine-borer, which Mr. A. C. Goodell, of Salem, Mass., presented to the Peabody Academy of Science. Mr. Goodell took the insect from a bureau that had been in the house for fifteen years and was new when bought.

An account of the other case I give in the words of Dr. Fitch: "The wood of the apple tree was formerly highly valued for cabinet work in this country. In 1786 a son of General Isaac Putman, residing in Williamstown, Mass., had a table made from one of his apple trees. Many years afterwards the gnawing of an insect was heard in one of the leaves of this table, which noise continued for a year or two, when a large long-horned beetle made its exit therefrom. Subsequently the same noise was heard again and another insect, and afterwards a third, all of the same kind, issued from this table-leaf; the first one coming out twenty and the last one twenty-eight years after the trunk was cut down." The proof of the identity of these beetles is not complete, but Professor Packard thinks they were *Cerasphorus balteatus.*

I find that *Eburia quadrigeminata* is not given in Hubbard and Schwarz's "List of Coleoptera found in the Lake Superior region," nor in the "Contribution to a list of Celeoptera of the Lower Peninsula of Michigan," by the same authors. But in Schwarz's "List of species" of Coleoptera found in Florida, *Eburia quadrigeminata* is mentioned as being "not rare on sugared trees in June." It is not given in LeConte's "List of species of Eastern New Mexico," but it is mentioned in his "List of species of Kansas and Nebraska." In his "New species of North American Coleoptera," he refers to it as "the ordinary *quadrigeminata* of the Southern States and the Mississippi valley." Thus, while it is a common enough insect over a large territory, no other case of its remarkable longevity seems to have been recorded. On comparing it with the other specimens in my collection, the only decided points of difference are the smaller size of the lateral spines of the prothorax and the terminal spines of the elytra; and the longer antennæ which, not exceeding the length of the body in the other specimens, are in this one one and a-half times as long.—*Jerome M'Neil, Indiana University, Oct. 26, 1886.*

ZOOLOGY.[1]

LEPTODORA IN AMERICA.—It may interest those of your readers who collect fresh-water Entomostraca to know that perhaps the most elegant and remarkable of that interesting group, *Leptodora hyalina*, Lillj., is much more abundant and easily obtainable than is implied by a note on page 896 of your last issue. First dredged by Professor S. I. Smith, in Lake Superior, in 1871, it was next found by me in June, 1877, in the Illinois river at Peoria, as reported in 1878, in Bull. 2, Vol. 1, of the Illinois State Laboratory of National History, p. 88. In the same bulletin I recorded its occurrence in the food of *Dorysoma cepedianum*, *Polyodon folium*, and *Hyodon tergisus*, all from the Illinois river. In our Bull. 3,

[1] Invertebrata edited by J. S. KINGSLEY, SC.D., Malden, Mass.

published in 1880, it is reported as eaten by young *Morone interrupta* and *Micropterus pallidus*, and again by Dorysoma. In the AMERICAN NATURALIST for August, 1882, it is further reported from both ends of Lake Michigan and from numerous small lakes—one only half a mile wide and not over twenty feet deep. In this lake, I remember, it was rather abundant. In Cedar lake, in Northern Illinois, we took it at night with Corethra larvæ, but we made our most notable haul of this species in Mendola lake, at Madison, Wisconsin, where we captured hundreds in the towing net on a bright summer day in 1885. It may be expectingly sought wherever, in permanent and rather deep water, sufficient numbers of the smaller soft-bodied Entomostraca occur to give it a fair chance for prey. It is not a swift swimmer, and its food must be abundant.—*S. A. Forbes.*

BLOOD OF INVERTEBRATES.—Dr. Howell, in Johns Hopkins "Studies," describes the blood of the king-crab, soft-shell crab, and a species of holothurian. In Limulus the blood is alkaline, quickly coagulating. It contains fine albumens which coagulate at different temperatures but which all belong to the globulin group. They resemble but are not identical with paraglobulin. Coagulation in the blood of Limulus results by the union of the corpuscles, and the existence of a coagulative ferment has not yet been proved. The fibrin is much like that of mammals in its solubility. Hæmocyanin certainly contains copper. In Neptunus (= Callinectes), the blood is alkaline but coagulates less quickly than that of Limulus. It contains two albumens to be classed among the globulins, and the coagulation is more complete than in the king-crab. The fibrin is very different from that of Limulus, and of it Dr. Howell says: "The difference seems to me to be too wide to suppose any close relationship between the two forms, especially as they have the same general environments; but until a series of similar observations is made on the scorpion or some arachnid, we will not have sufficient evidence to make any just inferences with regard to the relationship of these forms—that is, from the standpoint here assumed." In the holothurian, which was identified as *Thyonella gemmata*, two kinds of corpuscles were recognized, a red, hæmoglobin-bearing nucleated oval form and a spherical white nucleated form Coagulation was occasioned by the fusion of the white corpuscles, the red not taking part in the formation of a coagulum except as they were entangled in the meshes of the other.

In another article in the same publication Dr. Howell notices the existence of hæmoglobin in this holothurian, the second discovery of this element of the blood in any echinoderm. It coagulates at a lower temperature (56°–60° C.) than that of vertebrates, and is precipitated by a one per cent solution of acetic acid. Foettinger's observations on the existence of hæmoglobin in the aquiferous system of Ophiactis (Bull. Acad. Roy. Belgique, II, xlix, p. 402, 1880) appear to have escaped Dr. Horrell's notice.

THE BYSSAL ORGAN IN LEMELLIBRANCHS.[1]—The first portion of Dr. Barrois' article is a very full description of the byssal organs or its remains in forms from almost every family, twenty-one in all, and in forty-nine species of lamellibranchs.. There is also a historical résumé of the subject, description of additional glands, and a discussion of the homologous organs in gasteropods.

In *Cardium edule* the organ is described in full and others are compared with it. Its parts are: 1. "The cavity of the byssus," a large space in the center of the keel of the hatchet-shaped foot. 2. "*The canal* of the byssus," opening on the surface by a pore. 3. "The byssus," a hyaline thread running out from the cavity through the canal. 4. "Byssal glands," glandular cells lying below the epithelium and opening separately into the cavity. 5. "The groove" running forward from the canal along the margin of the foot to the anterior end. 6. "Glandular cells of the groove" opening into it among the epithelium cells. The epithelium is everywhere perfectly continuous and in the cavity is thrown into numerous lamellar folds.

Various departures from the plan are described and figured; there may be no functional byssus but the other parts may all be present, or the groove, or the glands, or even the cavity may be wanting, or there may be in the adult no trace of any of the organs. In the same family or even genus wide variations may occur. Thus *Tapes virginea* has no functional byssus, the cavity, glands and lamellæ are present, while in *Venus rudis* and others of the family no trace of the apparatus remains. In *Anomia ephippium* the ossicle by which the animal is attached is a true byssus, formed in a cavity lined with lamellæ, a precisely similar one being present in the foot of *Arca tetragona.* The anomalies of its relation to the parts of the body are explained by the lateral attachment of the creature. The "*cornet*" of Anomia, with its groove leading to the byssal cavity, is similar to the muciparous gland on the anterior part of the foot of *Pecten maximus.* In Unio and Anodonta a cavity in the keel of the foot is the only remains of the byssal organ in the adult. This, doubtless the water pore of Kollmann, Griesback and others, is lined with continuous epithelium. It is to be regretted that lack of material has prevented research into the embryonic condition of many of the retrograde forms.

Barrois also describes as characteristic of the lamellibranchs special muciparous glands in the anterior portion of the foot; these in some cases line the inside of a cavity, *e. g., Pecten maximus,* in other cases the organ being everted they line the

[1] Les Glandes du Pied et les Pores Aquiferes chez les Lamellibranches—Par le Dr. Th. Barrois, Lille, 1885, pp. 160, pl. x.

outer surface under the epithelium of a pedunculated club-shaped body *e. g.*, *Lucina lactea.* The view that the byssus of the lamellibranchs is homologous with the gastropod operculum is rejected on anatomical and histological grounds, and the muciparous byssiparous glands are thought to correspond with the "Lippen-drüsen" and "Fusshöhledrüsen" of Carriere, the one upon the fore-end of the gastropod foot, the other upon the creeping surface.

The second portion of the work is a full historical and critical review of the "water-pore" controversy. No new observations of importance are recorded and the position maintained by the writer is the same as already represented in this journal (see Vol. III, p. 130).—*Henry Leslie Osborn, Purdue Univ., Lafayette, Ind.*

On the class Podostomata, a group embracing the Merostomata and Trilobites.—In a paper read before the National Acad. of Sciences we have endeavored, by giving the history of the Xiphosura, Pœcilopoda and Gigantostraca, to show that while the name Xiphosura should be retained for the suborder of which Limulus is the type, the names *Pœcilopoda* and *Gigantostraca* have been applied in such different senses, that they can not well be retained for the Merostomata and Trilobita taken together in the sense we advocate. We have therefore proposed the term *Podostomata* for this class of Arthropoda. It is derived from ποὺς, ποδός, foot; and στόμα, mouth, in allusion to the feet-like or ambulatory nature of the cephalic appendages which surround the mouth in a manner characteristic of the group.

The class Podostomata may be defined as a group of marine arthropods in which the cephalic (Limulus) or cephalothoracic (trilobites) appendages are in the form of legs, *i. e.*, ambulatory appendages, usually ending in forceps or larger claws (chelæ), which in the sole living representative of the class are arranged in an incomplete circle around the mouth; the basal joint of each leg is spiny, so as to aid in the retention and partial mastication of the food. No functional antennæ, mandibles or maxillæ. Eyes both compound and simple. Respiration by branchiæ attached to the abdominal appendages which are broad and lamellate in Merostomata, and cylindrical with narrow gills in Trilobita. The brain supplying nerves to the eyes alone; the nerves to the cephalic or cephalothoracic appendages originating from an œsophageal ring; the ventral cord ensheathed by a ventral arterial system more perfectly developed than in insects or scorpions; coxal glands highly developed; with no external opening in the adult. The class differs from the Arachnida, among other characters, in having no functional cheliceres ("mandibles") or pedipalps ("maxillae"); in the cephalic appendages either ending in larger claws or forceps, or in being simple, the terminal joint not bearing a pair of minute claws or ungues like those of Arachnida and Insecta, enabling their possessors to climb as well as walk. Podostomata have no urinary tubes. Limulus undergoes a slight metamorphosis, while in trilobites the adult differs from the larva in having a greater number of thoracic segments.

From the Crustacea the Podostomata differ in the lack of functional antennæ, and mouth-parts; in the compound eyes having no rods or cones, in the brain innervating the eyes (compound and simple) alone; in the shape of the head and pygidium or abdominal shield, and in the arterial coat enveloping the central nervous cord.

The Podostomata are divided into two orders:

I. *Merostomata*, with three suborders: { *Xiphosura*, *Synziphosura*. *Eurypterida*.

II. *Trilobita*.

—*A. S. Packard.*

OYSTER CULTURE.—Dr. J. A. Ryder has a paper on this subject in the Report of the U. S. Fish Commission, detailing the construction of apparatus for the artificial culture of oysters which, from a theoretical standpoint, certainly seems practical. His plans have been outlined in this magazine, and hence need not be repeated. One of the points brought out is that Lankester's beautifully illustrated paper on green oysters (Quart. J. M. S. XXVI, pp. 71–94, pl. VII, 1885) contains hardly an addition to our knowledge of this phenomenon, besides the conferring of the name marennin on the coloring matter absorbed. Almost every point made was previously published by Puységur, Descaine or Ryder from two to five years before.

ECHINODERM DEVELOPMENT.—Fewkes has some observations on the development of Ophiopholis and Echinarachnius. He shows that in the former genus the endoderm arises by an invagination, but he cannot state the relations the blastopore bears to either mouth or anus of the pluteus. The mesoderm arises symmetrically either side the blastopore and apparently is of the nature of mesenchym, though not so stated. Nothing is given concerning the development of the mesothelial tissues. Apostolides who has previously studied the development of Ophiurans comes in for some apparently merited criticisms. In the sand-dollar, Echinarachnius, the early development is much the same. The pluteus is compared with that of Strongylocentrotus, from which it differs in the presence of large pigment-spots on each arm and the absence of "ciliated epaulettes." The whole of the pluteus is absorbed in the young sand-dollar, which has a very different appearance from the adult. The development presents but slight differences from other echinoderms.

THE BRAZZA EXHIBITION AT PARIS.—An exhibition of the contents of eighty boxes brought from the French possessions on the Congo, by M. de Brazza, was opened June 30, of this year, in the orangery of the museum. Two species of chimpanzee, *Troglodytes tschego* and *T. aubryi; Colobus guereza* (not before known) from West Africa; a new species of Colobus (*C. thollous* M. Edw.); a new Cercopithecus (*C. brazzæ*, M. Edw.); *Cercocebus agilis* M. E. (nov. sp.), and a single form of lemur, *Galago demidoffi*, are among the mammals of the region. *Hypsignathus monstrosus* (the title of a very large and hideous bat); and *Anomalurus erythronotus* are also curiosities. Antelopes do not abound on the Congo, but *Tragelaphus gratus* inhabits the marshes which border the river, and *A. maxwelli* also occurs. The buffalo is *Bubalus equinoxialis*, smaller than *B. caffer*, but equally redoubtable. Birds of prey were well represented in the collection, which contained also numerous cuckoos, among which *Centropus savorgnani* and *Coccystes brazzæ* (Oustalet) are new to science. There was also a new swallow (*Phedina brazzæ*). Most groups of African birds were well represented, but novelties do not appear to abound. Among the snakes were a new Heterolepis and a Microsoma. The collection of fishes added a Polypterus (*P. retropinnis* L. Vail.) of small size; and contained no less than twenty-three species of Characinidæ, several of which are new. It is a surprise to find this family, the headquarters of which is in South America, so abundant in West Africa. *Hydrocyon forskalii* reaches a length of two meters. Cyprinidæ were less numerous, among them were *Opsaridium fasciatum* L. Vail., resembling a sardine, and *Labeo coubie*, which grows to the length of a meter. Among fourteen species of Siluridæ *Doumea scaphyrhynchura* is new. No less than thirteen species of Mormyridae were represented. Acanthopteri are rare in the Congo region, but a few Chromidæ occur, among them *Acanthochromis regularis* and *A. seminudus* L. Vail. A species of flying fish, somewhat different from *Pantodon bucholzi* Peters, was among the curiosities. The fish are greatly infested with parasites.

Among the fresh water Crustacea M. Milne-Edwards has found five new species of Thelphusidæ.

Among insects the Coleoptera, and especially the Cetoniadæ, were best represented. Of the few molluscan specimens two species of Pharaonia seem to be new. There were many new species and some new genera of plants; while the ethnographical collection contained a very large number of objects, fetishes, pottery, pipes, iron and copper implements, articles in wood and ivory, etc. Two human skulls from Rio San Benito are remarkably dolichocephalic.

ZOOLOGICAL NEWS.—*Protozoa.*—Lankester reports in Nature (Sept. 2) the rediscovery of Archer's Chlamydomyxa which has not been seen since its original description twelve years ago. He found it encysted in Sphagnum, and after a short delay it threw out its protoplasmic filaments and presented an appearance which leads Professor Lankester "to admit that it is *less* closely related to Cienkowski's Labyrinthula than I had previously supposed." ——*Astrorhiza angulosa* a foraminifer dredged by the *Challenger* in a depth of one thousand fathoms, seventy miles east of the Açores, has been reported from the older Tertiary rocks of Victoria, Australia.

Sponges.—Dr. R. von Lendenfeld described the nervous system of several sponges at the recent meeting of the British Association for the advancement of Science. He called attention to the fact that in the sponges the most important organs are mesodermal (this is the case with the nerve cells) while in the Cœlenterates proper they are ecto- or ento-dermal. On the basis of this he proposes to divide the cœlenterates of Claus into Cœlenterata-Mesodermalia or sponges and Cœlenterata-Epithelaria or cœlenterates proper. It would seem as if these facts were an argument in favor of the view that the cœlenterates of Claus was not a natural group, a view for which there are many other reasons for adopting.

Cœlenterates.—Haddon states that his species *Halcampa andresii* is not valid but must stand as a synonym of *H. chrysanthellum* (Peach) Dana.——G. Y. Dixon gives some notes on *Edwardsia timida* with a colored plate showing the entire animal and some of the details. He regards *E. harasii* and *E. timida* as synonymous. His paper and that of Haddon are in Vol. v. of the Proceedings of the Royal Dublin Society.—— At the meeting of the British Association, Dr. von Lendenfeld described the development of *Phyllorhiza punctata* of Australia. The ephyra has eight marginal sense bodies; at the next stage it has twenty-four, then sixteen, while the adult has only eight.——The same author further stated that *Crambessa masaica* goes up the Australian rivers at the breeding season to deposit its young, just as does the salmon. This species has remarkably changed its color at Port Jackson within fifty years. At that time it was blue, but now is superseded by a brown variety. At Port Phillip, only a few hundred miles to the south, the blue variety still persists.——Dr. C. A. MacMunn has a paper on the chromatology of certain Actinias in the 176th volume of the Philosophical Transactions. The observations were made by means of the micro-spectroscope and show the existence of a respiratory coloring matter allied to hæmogolbin and of a biliverdin which is probably concerned in excretion. Concerning the "yellow cells" the author states that the fact that they appear to cause a suppression of those pigments which in other Actineæ appear to discharge a respiratory function is an argument in favor of their being regarded as symbiotic algæ. Moseley's actinochrome is regarded as decorative and is always confined to the tentacles. Another pigment is found in the eye spots which has a spectrum bearing some resemblance to that of a red pigment found in the eyes of certain insects.——Hickson has obtained the early stages of Tubipora. It is regularly holoblastic and there is an invaginate gastrula. He has also made some observations on a species of Clavularia from Celebes which go to show that this genus is closely allied to the fossil Syringopora, thus adding to the evidence that the latter is an Alcyonarian.—— The absence of special buds or gonophores to contain the sexual products of Hydra is by Professor A. M. Marshall regarded as a highly modified character due to the influence of fresh water. In Cordylophora, the other fresh-water genus, the ova develop in a zone of germination round the necks of the zoöids, before either the gonophore or the branch on which it will be borne is developed. Afterwards the ova migrate into the gonophore. Evidently Cordylophora is in course of suffering a transformation into sexual conditions like those of Hydra. The normal Hydroida are bisexual and develop Medusæ.

Echinoderms.—According to recent researches by R. Koehler, the circulatory system of the ophiurans is much like that of the Echinoidea, the same relations being found in the madreporic gland, the rings around the mouth and the branches arising from them.

Worms.—A. Giard described a new Rhabdocœle, *Fecampia erythrocephala*, at the meeting of the Academy of Sciences of Paris, September 13. It is parasitic and forms a cocoon. Attention was called to the fact that it resembles a parasite found by Lang in the foot of the mollusk, Tethys, which will probably also be found to form a cocoon.——Professor W. C. McIntosh, in Nature, of September 16, thinks that Phoronis and Actinotrocha are more abundant on the British coasts than the records would indicate.——G. Fritsch, in the Sitzungsberichte of the Berlin Academy (Jan. 28, 1886, p. 99), describes and figures the parasites of the electrical cat-fish Malapterurus. The novelties are *Corallobothrium solidum*, nov. gen. et. sp., *Tænia malapteruri* and a nematode, *Trichosomum papillosum.*——Schoyen describes, in the Christiania Forhandlingar for 1885, a new species of trematode, *Tylenchus hordei*, which forms galls on the roots of grass in which the eggs are deposited——Dieffenbach, has an anatomical and systematical paper on Oligochæte worms in the Bericht of the Oberhessichen Gesellschaft for 1886. He describes the anatomy of *Lumbriculus variegatus* and of the Tubificidæ, and has notes upon the Naids. A new genus, Pseudolumbriculus, and two new species, *Ps. claparedianus* and *Pachydrilus lumosus* are described. ——Sluiter has a paper on the Gephyreans of the Malay archipelago in the Tijdschrift of the Dutch East India Society, Vol. XIV (1886). The paper enumerates thirty species as known from that region, of which thirteen are now described for the first time. Some anatomical and histological notes are given.——Bell calls attention to the fact that in the land planarians the form of the head is very variable and cannot be used, as is often done, as a basis of generic division. He also states that Bipalium is sensitive to light, and if the light be too strong the specimen is killed.——Collet describes (Proc. Zool. Socy., 1886) a new species of Echinorhynchus (*E. ruber*) from Rudolphi's rorqual (*Balænoptera borealis*). He suggests that its early stages may be passed in *Euphausia inermis*, one of the Thysanopoda.

Mollusks.—Mr. George W. Shrubsole (Journal of Conchology, v, 66, 1886) has some notes on erosion of fresh-water shells. He noticed that in specimens of Planorbis living in the Trent canal, the shell was entire, but after being kept for three months in water from the River Dee considerable erosion had taken place. This suggested that the character of the water might have a prominent place in the erosion, and analysis showed that the water of the Trent canal contained about three times as much lime in solution as that from the River Dee. The fact that erosion did not set in at once is explained by the existence of the epidermis.——Mr. Edgar A. Smith states that the genera Turtonia and Cyanium are distinct, the latter genus possessing an internal cartilage. Jeffreys had previously united them.

Brachiopods.—Miss Agnes Crane describes (Proc. Zool. Soc., London, 1886) a new species of brachiopod (*Atretia frazieri*) from Port Stephens, New South Wales.

Arachnida.—G. Saint-Remy, at the meeting of the Paris Academy, Sept. 20, presented the results of his studies of the brain of the spider based upon the genera Tegenaria, Epeira and Phalangium. The brains of these forms have the same general plan of organization as that of the scorpion, on which a report had previously been made.——Adolph Horn describes the poison apparatus of twenty-one species of spiders in the Bericht of the Oberhessichen Gesellschaft for 1886. The poison glands consist of two elongate cylindrical cœcal sacs enveloped in connective tissue and spirally arranged muscles. Their ducts terminate near the tips of the mandibles.——Grassi describes a new arachnid in the Bulletin of the Italian Entomological Society (Vol. XVII, 1886) under the name *Kœnenia mirabilis.* He regards it as the type of a new order, Microthelyphonida. In general appearance the form stands nearest the thelyphonids, as the name indicates. Grassi points out twenty-four points in which it differs from the whip scorpions.

Ascidians.—Sluiter describes fourteen new species of ascidians from Billiton island. For one of them a new genus, Styeloides, is proposed.

Crustacea.—Professor C. L. Herrick gives (Bull. Denison Univ.)

an account of various stages in the development and points in the morphology of *Limnetis gouldii* and *Chirocephalus holmani*, two phyllopodous Crustacea. He also describes *Nyocryptus setifer*, a mud-living cladocerous crustacean.——Packard describes (Proc. Philos. Soc., XXIII, 380) the feet in Cryptozoe, a new genus of fossil Phyllocaridan crustacean, allied to Nebalia. The figures are too poor to show any detail, but the feet, according to the text, are much like those of Nebalia. Nothing had been known of the nature of the feet in the fossil forms before.

Vertebrates.—The "Segmental value of the cranial nerves" is treated of histologically and argumentatively by Professor A. Milnes Marshall, in Vol. I of Studies from the Biol. Laboratories of Owens College. The following table expresses the results arrived at:

Segment.	*Nerve.*	*Visceral cleft.*	*Visceral arch.*
1. Præoral	I. Olfactory	Olfactory	
2. "	III. Oculo-motor IV. Trochlear	Lachrymal	
3. Oral	V. Trigeminal	Buccal	Maxillary.
4. Postoral	VII. Facial VI. Abducent	Spiracular or hyomandibular	Mandibular. Hyoid.
5. "	IX. Glossopharyngeal	1st branchial	1st Branchial.
6. "	X. Vagus, 1st branch	2d "	2d "
7. "	" 2d "	3d "	3d "
8. "	" 3d "	4th "	4th "
9. "	" 4th "	5th "	5th "
10. "	" 5th "	6th "	6th "
11. "	" 6th "	7th "	

The vagus supplies the six posterior branchial clefts in the Marsipobranchii and Notidanus, and is therefore considered equivalent to *at least* six segmental nerves. The XIth, or spinal accessory, and the XIIth, or hypoglossal nerves are not constant as cranial nerves throughout the vertebrate series, and are not dealt with in this paper.——By a study of the branchial sense-organs of Ichthyopsida, Dr. J. Beard endeavors to work out the same problem. He also finds eleven head-segments in sharks, but they differ from those of Professor Marshall, since the radix longa of the ciliary ganglion and the auditory are ranked as segmental nerves, the facial is allowed two segments, and the vagus four only.——To the first volume of Studies from the Biological Laboratories of Owens College, Professor A. Milnes Marshall contributes some observations on the cranial nerves of Scyllium. He does not attempt to determine the homologies between the nerves of Scyllium and those of higher vertebrates, preferring to wait for more positive evidence.——Those interested in nervous anatomy may find an exhaustive article on the central nervous system of the baleen whales, by G. A. Guldberg, in the Forhandlingar of the Scientific Society of Christiania for 1885, published during the present year.——G. Fritsch describes the histology of the skin and the lateral-line organ of the electric cat-fish in the Sitzungsberichte of the Berlin Academy of Science for April, 1886.

ANTHROPOLOGY.[1]

AUSTRALIAN MEDICINE MEN.—In one respect it is unfortunate that the sorcerers among savages should be called "medicine men," they are not merely practitioners of medicine. Furthermore, all savage tribes have arrived at a certain stage of empirical medicine and know the healing and poisoning qualities of certain minerals and plants. The dawn of medicine, as of all else which we believe and practice, was in the day of the primitive savage.

We are concerned here with the doctor or medicine man, who, in Australia, Africa or America, relies upon his influence and power over the spirit world to work cure or to save life.

In our own country patient study is revealing much concerning this important class. Major Powell and several other gentlemen of the Bureau of Ethnology have paid personal attention to them. We are indebted to the London Anthropological Institute for the publication of important papers upon the "Blackfellow Doctors" of Australia, notably that of Mr. A. W. Howitt, in Vol. XVI, pp. 23–58. The men and women who in lower tribes stand for the clergy as distinguished from the laity, or uninitiated, are variously styled doctors, wizards or witches, sorcerers, seers or prophets, mediums, soothsayers, necromancers, rain-makers (better weather-makers), magicians, augurs, fortune-tellers, enchanters, priests, personators, diviners, etc.

Now these can readibly be divided into two classes or functions, viz., those who see into, understand and reveal the spirit world; and those who have more or less control over it, compelling it to do their bidding.

The medicine man, doctor, sorcerer, wizard, fetish man are all of the latter class. Whatever disease and death may be, whether merely the person or spirit of some noxious thing or an independently existing spirit, one of the powerful charmers can induce or compel it to do his bidding, either by direct command or by some diplomatic action called magic.

In the collection of material for a scientific investigation of this class of persons, I have found it convenient to adopt the following questions:

1. What are the actors called and what social rank do they hold.
2. By what rites or initiations do they attain to the privileges of their class.

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

3. What do they profess to do? What are they believed to be able to do? That is, to which class above named do they claim to belong?
4. What do they actually perform? What is their mode of treatment? Do they sing, dance, go into ecstasy, suck the wound, spit out the disease in the form of a bone, stone, &c.? That is, not what they claim to do, but what do they actually? What dress, paraphernalia, implements and dramatic performances do they resort to? What fees do they charge?
5. What is the area of their operation, both in the spirit and in the mundane world? Some cause, others cure disease. Some have influence in one sphere, others in other spheres of spirits. Again, some operate on the sick, others on the conjured, lovers, lost cattle, epilepsy, etc.
6. Folk-lore, beliefs and customs of the folk in view of the foregoing subjects of inquiry.

Thanks to the efforts of Mr. Howitt and others we are able to answer some of these questions concerning the Australians. "I have adopted," says this author, "the term medicine men as a convenient title for this memoir, but the term 'doctor' or 'blackfellow doctor' is always used in Australia for those men in a native tribe who profess to have supernatural powers. The doctors are magicians or wizards. I may roughly define doctors as men who profess to extract from the human body foreign substances which, according to aboriginal belief have been placed there by the magic of other doctors, wizards or supernatural beings, such as the *Prewin* of the Kurnai, or *Ngarang* of the Woiworung."

The social relations of these blackfellow doctors to the community varies from tribe to tribe. In some tribes the head man need not be a wizard, but is either a very brave man or a man of influence. Among the Muning tribe the *gommera* is both head man and sorcerer combined. He is the *biambian*, or master of his local group. The oldest *gommera* is the *bambian* of the other *gommeras*. He must be gray bearded, speak several dialects and "bring things out of himself."

A vast deal of mystery surrounds the education of the doctors. Mr. Howitt narrates at full length, pp. 49–52, the story of his own initiation told by one of his friends.

As said, the doctor and wizard are associated in function. They profess to project a quartz crystal or black stone against or into their victim or into their own bodies, to cause magical things to enter a victim by burying them in his tracks, and on the other hand to annul the power of these introjections. These same clergy claim to know and to compel or restrain the weather (meteoroscopy or meteorocracy), to fly through the air, to metamorphose themselves into animals, to be invisible and to render persons and things invisible, to talk and associate with ghosts and familiars, to abstract a man's fat, to discover the causes of death, disease or evil fortune, and finally to produce a distant effect upon a person by performing it upon a part of him or something he has touched or held.

There comes out in this study the very best interpretation of the synecdochical sorcery and medicine. Why should a piece of the man or of something he has touched be burned with the thorn, burr or thing that is to do the fatal action? Why simply to give the spirit of this hurtful thing the scent of the man, just as hunters train young dogs by allowing them to smell a piece of the hide of the animal they wish to be caught.

As to the actual performances, dress and implements of the doctors, Mr. Howitt is very explicit.

All doctors carry rock crystals and use them in their practice. Some diseases, such as rheumatism, are supposed to proceed from rock crystals. Indeed the afflicted can feel the little stones in the affected part. The doctor frequently sucks the part in pain, expelling a foreign body, a mouthful of wind or a quantity of blood. He manipulates and squeezes the patient, singing charms and performing innumerable mysterious actions.

In producing a spell the doctors often fasten the fatal object to the end of a throwing stick with hawk feathers and some human or kangaroo fat, and stick the weapon slanting in the ground before the fire. It falls down. The wizard has meanwhile sung his charms and the spell is completed. Again the pounded flesh of a dead man is mixed with tobacco, or the cones of the *Casuarina quadrivalvis* are thrown into the fire so that their spirits or little seconds may get under his eyelids and produce granulation.

A powerful magical implement is the *yulo*, an implement twelve inches long made of the leg bone of a kangaroo, pointed, having attached to it a long cord of twisted sinews, thirty-six inches long, ending in a loop. It is used by the wizard for binding their victims from whom they wish to take the kidney fat. Watching until the victim sleeps he creeps up, passes the bone under his knees, around his neck and through the looped end of the cord.

It is also pointed at people and is supposed to cause death by entering into them. The wizard was supposed to swing the *yulo* around his head and sling it at his victim.

From Mr. Howitt's language we would suppose they really take the fat from the dead and eat it, and that he really binds his living victim with the *yulo*, or knocks him down with the *brepent*, sits astride his chest, cuts open the right side below the ribs, extracts his fat, brings the cut edges of the wound together, and bites them to make them join so that no scar will be visible.

We will close this note with allusion to the *yenjin*, a song of elopement sung by a class of wizards called *Bunjil yenjin*, whose occupation is to aid in the elopement of young couples. When a young man wanted a girl whom he could not obtain from her parents, he employed one of these professionals. The latter would lie near the camp with the youth and his companions and sing a song, the others joining in the chorus. When he thought his spell strong enough he ceased, and the young folks, *nem. con.* would take to the bush together.

THE ICONOGRAPHIC ENCYCLOPÆDIA.—The second volume of this publication is based on von Eye's Culturgeschichte, but has a chapter on Prehistoric Archæology, by Professor Daniel G. Brinton, which doubles the value of the original work. We have no hesitation in placing this article at the head of all compendiums upon this subject. The method of treatment is historical.

The introductory chapter is devoted to a sketch of the science and the methods and problems which have for the past quarter of a century engaged the minds of archæologists. The characteristics and art productions of the European age of stone in its two periods, the palæolithic and the neolithic; the age of bronze and the age of iron are treated in the first fifty pages.

The prehistoric archæology of the western hemisphere is treated under the following analysis:

I. Palæolithic period.
  1. The Palæolithic period of North America.
  2. The Palæolithic period of South America.
    Concluding remarks on the Palæolithic period.

II. Neolithic period.
  A. Archæology of the United States.
    1. Art in stone.
    2. Pottery.
    3. Bone.
    4. Shell.
    5. Metals.
    6. Other ancient remains.
  B. Archæology of Mexico and Central America.
    1. Art in stone.
    2. Metals.
    3. Pottery.
    4. Bone and Shell.
    5. Paper.
  C. Archæology of the Andean nations.
    1. Art in stone.
    2. Art in bone, shell and wood.
    3. Metals.
    4. Pottery.
    5. Other arts.
  D. Archæology of Southern and Eastern South America and the West Indies.
    1. Art in stone.
    2. Pottery.
    3. Metals, bones and shell.
      General observations on American art.

It is marvelous to see how much Dr. Brinton has crowded into such a small space. No one is expected to say everything in an encyclopædic article. The only improvement we could suggest would have been to give with each paragraph a reference to the most distinguished treatise on that topic. This would have done little more than to fill out the closing lines, and would have made the paper little longer. It will probably be a long time before any other author half so qualified as Dr. Brinton will try to cover the whole ground of American archæology.

MICROSCOPY.[1]

REVOLVING AUTOMATIC MICROTOME.—The microtome represented in the accompanying cut is the invention of Adam Pfeifer, mechanic and instrument-maker to the Biological Laboratory of the Johns Hopkins University.

The machine is designed to save time and labor in the preparation of series of sections, and to attain at the same time the greatest uniformity in the thickness of the sections.

The mechanism is very simple. The frame (Fig. *B*) contains a horizontal screw beneath the sliding carriage (*C*). The carriage carries the knife (*K*). This carriage is moved forward by turning of screw. Two arms of the frame support the axis (*J*) of the revolving wheel (*E*), to which the imbedded object is attached. The knife (*K*) is clamped in an upright position on the arms rising from the sliding carriage, so that the edge of the knife is in the same horizontal plane with the center of the axis (*J*). Thus, as the sliding carriage is moved by the screw, so the knife is moved to or from the revolving object. The carriage slides by means of grooves on raised tracks of the frame, and is not directly connected with the screw, but is simply pushed by nut (*N*). This arrangement makes it impossible that any slight eccentricity of the screw should cause a jolting of the carriage.

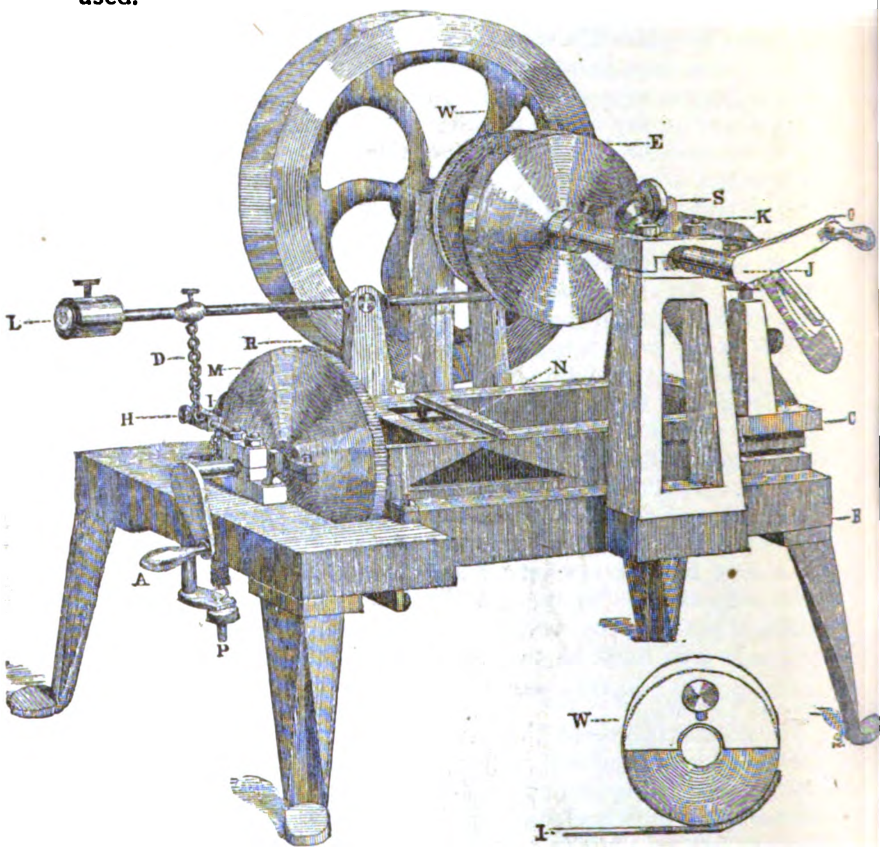
The head of the screw is a solid wheel (*M*) at the end of the frame, and has 250 ratchet-teeth on its circumference. The screw has twenty threads to the inch (= .025^{m}). The knife, therefore, is moved an inch by twenty revolutions of the screw; and as there are 250 teeth to the revolution, each tooth represents $\frac{1}{20 \times 250} = \frac{1}{5000}$ inch (.005^{mm}).

The handle (*O*) turns the axis (*J*), to which is attached the wheel (*E*). This wheel is four inches in diameter, and to it is fastened the clamp which holds the object to be cut. The axis also carries a fly-wheel and an adjustable eccentric wheel (*W*), which is figured apart in a corner of the illustration. This eccentric moves a lever (*L*), the long arm of which is connected with the small chain (*D*). The chain lifts a small lever (*H*), which works by means of a catch (*I*) on the teeth of the screw-head, causing the screw to revolve. The small lever is steadied and pulled back to its place by a spiral spring (*P*), while another spring-catch underneath the frame prevents the ratchet-wheel from turning back. By properly adjusting the eccentric wheel

[1] Edited by Dr. C. O. WHITMAN, Mus. Comparative Zoölogy, Cambridge, Mass.

the levers may be made to act so that the catch (*I*) will take any desired number of teeth by every revolution of the object. The knife moves only during that part of the revolution when the object is not in contact with the knife. The ribbon of sections slides downward from the knife and is caught on a piece of paper placed upon the table.

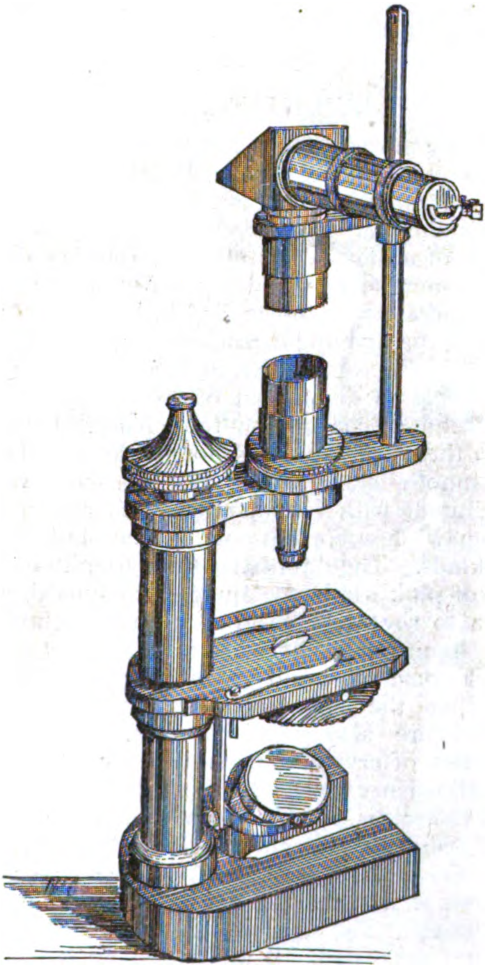
The wheel holding the object, as well as the razor, can be moved so that almost all parts of the edge of the razor can be used.



The frame bed of the microtome is made of iron, the screw of steel, and all the rest is brass. Any ordinary microtome knife or razor may be used.

The machine has been in use for a year and gives the greatest satisfaction. It can be used with great rapidity, but so far the best results have been obtained at a rate of not over a hundred sections to the minute. The only possible error in a revolving microtome of this kind is theoretical—namely, that owing to the circular motion of the object, each section is part of a hollow cylinder. But in reality, with objects of ordinary size, this error is not apparent, and even under a high magnifying power there is no perceptible difference between sections cut by this microtome and those cut by ordinary slide microtomes.

EMBRYOGRAPH FOR USE WITH ZEISS MICROSCOPES.—This piece of apparatus, which is the work of Adam Pfeifer, the instrument-



maker of the Biological Laboratory of the Johns Hopkins University, renders the Zeiss-Oberhausen camera available for drawing objects under very low magnifying powers. It consists, first, of a collar fitted to the arm of the microscope, and furnished with a short draw-tube, which can be placed with the objective either above or below the arm ; and second, of a vertical rod, supported on an arm which is clamped under the collar of the draw-tube, and carries a second movable arm resting in a collar to support the camera. This arm is held in place, by a thumb-screw, and it may be set at any point on the vertical rod. When the Zeiss *a.a.* objective is used, and the camera is lowered as much as possible, an image magnified about three diameters is projected on to the paper, and any amplification greater than three diameters may be obtained by varying the height of the camera, and by the use of the higher objectives.

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SCIENTIFIC NEWS.[1]

— One of the most remarkable salt formations in the world is located on the Isle of Petit Anse, Southwestern Louisiana, 125 miles due west from New Orleans. It is owned by the Avery family. This singular salt deposit is sufficiently unknown to bear the light of a more thorough investigation than it has had. The deposit is pure crystal salt. So far as it has been traced, there are 150 acres of unknown depth, explored 140 feet down. The surface of the bed undulates from one foot above to six below tide-level. The earth covering the salt ranges from ten to twenty-three feet in depth, but one hill rises 183 feet above, showing that an after-formation took place. On the top of the salt, beneath the earth, have been found the remains of the mastodon, mammoth sloth, horse (*Equus fraternus*), tusks and bones intermixed with Indian relics such as arrow and spear points, tomahawk heads, paint pots, mortar and pestle and pottery of all kinds. The dip of the salt is eight degrees. There is a deposit of pink sandstone quite decomposed, a coal formation thirteen to seventeen feet thick and seventy-two per cent carbon, the lignite cropping out a hundred feet above the sea. Over the salt come pink and yellow clay beds, then the sandstone and then the clay, each stratum trending towards the north. There are also sulphur springs. The salt is a conglomerate mass of crystallizations, which in the mine look like dark salt, but when exposed to the light are seen to be white. By analyses the salt is $99\frac{88}{100}$ per cent pure; the remaining $\frac{3}{25}$ is made up of sulphate and chloride of calcium. The position of the salt shows it to be older than the coal and sandstone which lie above it, and also the mastodon and contemporary prehistoric mammals. The deposit was discovered in 1862 while a well was being excavated. It was seized by Jefferson Davis and afterward by Admiral Farragut. It is now worked by a New York concern which pays the Averys $5000 per month royalty. To show the value of land here, it may be stated that a single acre, on which grow little peppers, yields a clear profit of $10,000 per year on the well-known Tobasco table sauce.

[1] Edited by WM. HOSEA BALLOU, 265 Broadway, New York.

— Dr. Isaac Lea, the distinguished conchologist of Philadelphia died recently at an advanced age. He was born in Philadelphia, and during his earlier life was engaged in business as a bookseller. His interest is science was however always great, and he retired from business early with a competence, and devoted himself to his favorite pursuit. His specialty was conchology, and in this field his publications, on both recent and extinct forms, are numerous and well known. He was for several years president of the Academy of Natural Sciences of Philadelphia, and was an honorary member of the numerous illustrious societies, including the most important scientific bodies of England, France, Germany, Italy, Switzerland, Austria, Belgium, Greece, India and Russia. He entertained 200 members of the British Association at his Long Branch villa in 1884.

— The "hog mice" referred to by Mr. Aldrich in "A curious superstition," on p. 744 of the present volume, are apparently the shrews, concerning which superstitions of the same character were formerly common in England. References to the belief that these animals would cause injury to the foot of man or beast over which they passed, may be found in Bell's "British Quadrupeds," and White's "Natural History of Selborne," where may also be found some curious remedies for the lameness resulting.—*J. S. K.*

— At the recent meeting of the British Association for the Advancement of Science at Birmingham, the following appropriations for biological research were made: Lymphatic system, £25; Naples zoölogical station, £100; Plymouth biological station, £50; Granton biological station, £75; Zoölogical Record, £100; flora of China, £75; flora and fauna of the Cameroons, £75; Migration of birds, £30; British marine area, £5. The number attending the meeting was about 2500.

— One will have to go far to find a more delicious bit of nonsense than is contained in the following title of an article which appears in one of the scientific journals: "The identification of the British inch as the unit of measure of the Mound-builders of the Ohio valley." The publication committee must have been napping when this article was accepted.

— Dr. Baur, of the Yale College Peabody Museum narrowly escaped serious injury recently by the explosion of a decomposed ostrich egg. The sudden escape of the confined gas knocked him senseless, but as the egg was wrapped in a cloth his eyes happily escaped injury. That the doctor had to submit to a disinfection afterwards will surprise no one.

— The species of tree moss, *Ursea barbata*, grows to a considerable length on the south shore of Lake Superior. Specimens recently added to the collection at the Northwestern University, Evanston, were four feet long. The moss trails from the limbs *a la* the parasitic "Spanish moss" of the South. It is of a beautiful pea-green color.

— The streams penetrating the Gogebic Iron range, near the south shore of Lake Superior, are so black with discoloration from the ore, that fish can not live in them. This is particularly true of the Montreal river, the northern State line between Wisconsin and Michigan.

— Professor Henry L. Osborne, of Lafayette, Indiana, has taken the position of editor of the American Monthly Microscopical Journal, during the absence of Mr. Hitchcock in Japan We look for an improvement in the journal.

— Mr. J. A. McNiel, of Binghampton, N. Y., offers for sale forty pieces of pottery in one-half bbl., seventy-five pieces pottery and fifty stone implements in bbl. These are far above the average in style and desirability.

— The k. k. Naturhistorischen Hof-museum in Vienna has begun the publication of its annals, the first and second numbers of Vol. 1 having appeared.

— A single gill-net in use among the Apostle islands, in Lake Superior, is three miles long and requires an entire day to empty and set it.

— A portrait of Hermann Schlegel, of Leiden, may be found in the Altenburg Mittheilungen for 1886.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

The National Academy of Sciences held its autumn meeting at Boston, Mass., commencing November 9. The following papers were read:

November 9th:

The solar-Lunar spectrum, by S. P. Langley; A basis of chemistry, by T. Sterry Hunt; On lemurine reversion in human dentition, by E. D. Cope; On .th columella auris of the tailed Batrachia, by E. D. Cope; Change in Mya since the Pliocene, by Edward S. Morse; The Cave Fauna of North America, with remarks on the anatomy and origin of blind forms, by A. S. Packard.

November 10th:

Primitive forms of Cephalopoda, by Alpheus Hyatt; A case of evolution in the migration of forms, by Alpheus Hyatt; Lituites of the limestones of Phillipsburg, Canada, by Alpheus Hyatt; A chart of the stars in the group Præsepe, by C. H. F. Peters; A catalogue of stars from positions in various astronomical periodicals, by C. H. F. Peters; A catalogue of bright lines observed in the atmosphere of β Lyræ, by O. T. Sherman; On the relative motions of the Pleiades group deduced from measurements made with the Kõnigsberg and Yale College heliometers, by W. L. Elkin.

November 11th:

Archæological explorations in the Little Miami valley, Ohio, conducted by F. W. Putnam and C. L. Metz, by F. W. Putnam; Draper memorial photographs, by F. C. Pickering; Some observations with Pritchard's wedge photometer, by C. A. Young; The question of barometer exposure, by C. Abbe; On the construction of new tables of Saturn, by G. W. Hill; On the relation of the Green Mountain rocks to the Taconic, by R. Pumpelly; Hardness and chemical indifference in solids, by T. Sterry Hunt; On wind as a seed-carrier in relation to one of the most difficult problems in geographical distribution, by Alfred Russell Wallace.

The sessions were held in the Institute of Technology. On Wednesday evening, November 10th, the academy was entertained at the house of General Francis Walker, president of the institute.

BIOLOGICAL SOCIETY OF WASHINGTON, Oct. 30, 1886.—Communications: Mr. Wm. H. Seaman, Notes on *Marsilia quadrifolia;* Dr. Theo. Gill, The characteristics of tæniosomous fishes.

Nov. 13.—Communications: Dr. Filip Trybom, of Stockholm, Recent progress in zoölogy in Sweden; Mr. J. W. Chickering, Jr., Travels in Alaska; Mr. Wm. H. Dall, Historical notes on the department of the U. S. National Museum.

NEW YORK ACADEMY OF SCIENCES, Oct. 18, 1886.—The following paper was read: Earthquakes: what is known and believed about them by geologists, by Professor John S. Newberry.

Oct. 25.—The following paper was read: Notes on the geology of Block island and Nantucket, by Mr. F. J. H. Merrill.

Nov. 1.—The subject of earthquakes and volcanic action formed the basis of a discussion, supplementary to the paper of Oct. 18.

Nov. 8.—The following paper was presented: A limit to the height of atmosphere, by Dr. Henry A. Mott.

Nov. 15.—The following paper was presented: Recent investigations on the mitigation of pathogenic Bacteria (with illustrations by the lantern and microscope), by Mr. C. E. Pellew.

Nov. 29.—Professor Albert R. Leeds, of the Stevens Institute of Technology, read his paper on the purification of water supplies, announced for the 22d, and unavoidably postponed.

BOSTON SOCIETY OF NATURAL HISTORY, Oct. 6, 1886.—At the first meeting after the summer vacation, Professor W. O. Crosby described the geology of the region known as "Paradise," near Newport, R. I. It had previously been studied by several geologists, the latest being Mr. Dale. The chief points brought out were that the middle ridges of the region were not stratified rocks as they had usually been regarded, but intrusion veins. This fact necessarily changed the veins of the axes of the stratified slates forming the outer ridges.

Professor Wm. T. Sedgwick exhibited some apparatus recently devised at the Institute of Technology for elementary teaching of some facts in human physiology. There were models to show the various proportions of water, proteids, fats, etc., in the human body, and in the daily income and outgo. Then in bottles were shown the relative proportions of the same constituents in milk, butter, meal, etc.; while charts illustrated the comparative food value of twenty-five cents' worth of some forty common food stuffs. Incidentally it was brought out that the pork and beans for which Boston is so celebrated, was a natural dish and one which could hardly be excelled for nutritious qualities, while oleomargarine is a benefit to all mankind, the farmers excepted. The apparatus will doubtless prove of great value in conveying to pupils in our common schools a knowledge of just those principles of physiology which will be of the most value in after life.

Oct. 20.—Mr. S. H. Scudder described the mode of life of a fossil beetle.

Nov. 3—Mr. James H. Emerton described the anatomical changes undergone by the milkweed butterfly in its chrysalis stage; and also spoke of the flying spiders on Boston common.

Nov. 17.—Dr. George L. Goodale reviewed recent investigations relative to the absorption of coloring matter by living vegetable cells.

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