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A. S. PACKARD, Jr., AND EDWARD D. COPE.

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THE ANCIENT GLACIERS OF THE ROCKY MOUNTAINS.

BY ARCHIBALD GEIKIE, F.R.S.[1]

AMONG the many profoundly interesting questions in American Quaternary geology, one of the most important is unquestionably the determination of the area and movements of the ice during the glacial period. In the Eastern States much has now been done towards the elucidation of this problem. The general southern limits of the great ice sheet, and its course from Canada southwards have been more or less definitely fixed; though much remains to be done before our knowledge even on these points can be regarded as more than a mere outline of the truth. When, however, we try to realize the relations of the ice-sheet westward of the Mississippi basin, we soon perceive the meagreness of our information in regard to these vast western regions. But it is there that one of the most remarkable parts of the glacial problem must be solved. The important labors of Dr. Percival and Profs. Whitney, Irving and Chamberlain, have shown that even within the area embraced by the northern ice-sheet, there was a tract of about 12,000 square miles in Wisconsin that escaped glaciation. Prof. Irving points out that this tract does not owe its immunity from glacial drift to its being higher than the surrounding ground; on the contrary, it is actually lower than the ice-ridden region in Minnesota to the west of it. He supposes it to have escaped because it lay between deep depressions leading out of Lake Superior, by which the great mass of ice, filling that basin, moved off to the south. If this be the true explanation, and it bears strong evidence of probability,

[1] Director of the Geological Survey of Scotland.

the ice-sheet must evidently have become considerably attenuated in the Wisconsin region, though still retaining momentum sufficient to carry it down the Mississippi valley into Missouri and Kansas. In Dr. Aughey's recent interesting volume on Nebraska, the extension of the ice westward into that State is clearly proved, and the ice-movement is there shown to have taken a south-south-east direction, or down the Missouri valley. No doubt the glacier had thinned away greatly in that region. Its south-western and western margin, however, remains to be traced up the plains watered by the Missouri. And the day is probably not far distant when the work so well done by Mr. Dawson, in British Columbia, will be prolonged into the Missouri region, and the precise limits and course of the ice-sheet will be mapped across the whole breadth of the continent.

Subsequent explorations have amply confirmed the original observation of Prof. Whitney as to the driftless nature of the surface of the vast interior region lying between the Missouri valley and the Sierra Nevada. The fact may seem almost incredible that the low ground of Eastern North America should have been buried under a southward-creeping ice-sheet, from which the lofty plateaux of the West remained free. The cause of this difference was probably meteorological, as Prof. Dana had pointed out, the snow-fall over the Rocky mountains and western ranges having been insufficient to give birth to a general ice-sheet descending from those heights into the plains. But the question remains: what was the probable condition of the West during the time when glaciation in the East was at its height? We must remember that a considerable portion of the ground through which the drainage of the western plateaux and mountains now reaches the sea, was then blocked up with ice. The valley of the Missouri with all its tributaries on the right down into Kansas, was under ice. Any water-drainage from the west would be ponded back by the great tongue of ice that crept continuously southward from British America, and would no doubt flow parallel with the ice and join the streams, escaping from its melting end. I am not aware, however, that any evidence of such arrest of drainage has yet been met with, though it is a point deserving of attention.

That the mountain ranges of the West had their glaciers, is now well known. Even at the present time, as Mr. Clarence

King announced in 1871, there are true glaciers in the Sierra Nevada, and Dr. Hayden's Survey has more recently found others among the Wind River range in the Rocky mountains. But during glacial times the quantity of snow and ice in some of these uplands, was enormous. In the Uintah mountains the traces of vanished glaciers are singularly fresh. Beautiful horse-shoe-shaped morainal-mounds, occurring far down the valleys, mark pauses in this final retreat of the ice. These have been well described by Mr. S. F. Emmons and Mr. Clarence King, whose narrative I can fully confirm from my own observations. In the Wasatch mountains, also, as the same observers have shown, some of the principal valleys were occupied by glaciers. I was particularly struck by this proof of glaciation in the region of the Cottonwood cañons. At the mouth of the gorge of the Little Cottonwood stream, a pile of morainal-heaps lies on the edge of the highest of the series of ancient terraces of Great Salt lake. There can be little doubt that at the time of the greatest extension of this sheet of water, when filling the vast basin named Lake Bonneville by Mr. Gilbert, it escaped by a northern outflow into the Snake river and the Pacific, glaciers crept down the valleys on its eastern side, and in one case, at least, advanced into its waters. At this locality the ice descended to within 5000 feet of the present sea level.

But the most startling testimony to the size of the western glaciers, which I met with in the course of a recent journey through these regions, was supplied by the valley of the Yellowstone river. I entered this valley from Fort Ellis, in Montana, a little above the first or lowest cañon. One of the earliest objects to arrest my attention was a prominent rock, like a cottage, in the middle of the alluvial plain. I found it to be a large block of granite measuring 18 × 12 × 10 feet, and weighing upwards of one hundred and fifty tons, which with many smaller erratics lay upon rudely crescent-shaped mounds. There could not be the smallest doubt that these were moraine-heaps, nor that the glacier which carried them must have been very much larger than any of which I had seen traces among the Uintah or Wasatch mountains. The broad valley is here full of moraine-stuff. How much further north the transported material extends, I had no opportunity of ascertaining. But as it is still in full force at the 5000 foot contour line, it evidently descends to a much lower level than among the Uintah and Wasatch mountains, three hundred and fifty miles further south. Here then was a great glacier moving northwards, while in British Columbia, on a parallel only about two hundred and fifty miles further north, there was a massive ice-sheet moving southward. It will be a point of no little interest to trace these two converging ice streams towards each other.

In ascending the Yellowstone valley towards the National Park, scattered moraine-mounds and abundant transported blocks continue to denote the course and size of the former glacier. I was wholly unprepared, however, for the intense glaciation of the second cañon. This ravine had been cut to a depth of at least eight hundred or one thousand feet in the schists and other older crystalline masses of the region. At its lower entrance a few prominent rocky knobs project from the steep declivity upon the flat alluvium on the left bank of the river. Great was my astonishment to find these spurs of the mountain-side as perfectly smooth, polished and striated as those at the margin of any Swiss or Norwegian glacier. The striæ were directed upward over the ridge, and showed how the ice had been pressed out of the gorge over this opposing barrier of rock. The steep sides of the cañon have been ground smooth and striated in the same way, as far up as I could see, certainly not less than eight hundred feet. Even from below the eye could follow the deep parallel scorings along the ice-worn sheets of gneiss. The glaciation reminded me more of the valley of the lower Aar glacier, above the Grimsel, than of any other European piece of ice-work. As the ice-worn surfaces descend to the modern alluvium of the river, it is clear that there has not been any large amount of erosion in the cañon since the glacier left the scene. I think it is equally certain that the cañon already existed before the glacial period, and that the work of the ice has been to grind it out deeper and wider.

Above the second cañon the moraine-heaps become more abundant and tumultuous. Here and there they enclose small lakes. The tributary valleys too have their moraines and erratics and must have been filled up with ice. Impressive testimony to the magnitude of these ice-masses, is found in that section of the Yellowstone and its surroundings, between Gardiner's river and Mount Washburn. The trail from the Mammoth springs by Blacktail Deer creek, over to the Yellowstone, leads the traveler across mounds of glacial débris among which huge boulders of granite and granitoid gneiss are conspicuous. The transported character of these materials is all the more evident from the fact that the platform of solid rock on which they rest often consists of various lavas and other volcanic masses. Some parts of the route present long smooth slopes dotted with boulders precisely like some Scottish boulder-clay moors. The granitic blocks are conspicuous objects even from a distance, owing to their size, a length of six to eight feet being common among them. These signs of glaciation can be traced up to and across the water-shed leading over to the Yellowstone valley. They prove beyond question that not only was that valley filled up with ice, but that the glacier plowed over the ridge one thousand feet above the valley bottom and passed into the country lying to the westward. No old glacier valley in Europe presents a more characteristic scene of ice-drift erratics than does that of the Yellowstone for three miles below Lower falls. The large blocks of granite, gneiss and other crystalline rocks are scattered about so profusely that one might cross the ground for some little distance by leaping from boulder to boulder. The blocks are heaped upon mounds of moraine-stuff, perched on ice-worn hammocks of gneiss, and stream over the horizontal volcanic sheets through which the ravines have been cut.

As the determination of the distribution of the erratics gives an approximate indication of the thickness of the ice, I noted with the aneroid the positions of blocks of granite, gneiss and other non-volcanic rocks on the way up to Mount Washburn, which projects so conspicuously into the valley of the Yellowstone. These blocks get fewer in number and smaller in size as they are followed upwards; but I observed one of three feet long at a height of 8650 feet on the west side of the ridge which rises southward into Mount Washburn, and another about one foot in diameter at a height of 8900 feet. From the position in which these erratics lie, the traveler looks clear over the Yellowstone valley for many miles to the east and west. The general level of the valley-bottom above the edge of the cañon, on the north of Mount Washburn, may be taken at between 6000 and 7000 feet. South from that eminence it rises to more than 8000 feet. The general slope is about 2000 feet in fifteen miles, or roughly, about one hundred and thirty-three feet per mile. The ice, after passing the barrier of Mount Washburn, cannot have been less than 1650 feet thick (= the height of the three feet boulder on the crest of the ridge), and probably was at least 1900 feet (= the height of the highest observed block). That mountain projecting as a great barrier in the pathway of the ice served to ridge it up, and no doubt partly to deflect it. I observed a granite block south of Dunraven pass, on the south side of the mountain, at a height of 8600 feet, and moraine-stuff and erratics, at intervals, down to the very edge of the Grand cañon, and beyond even as far as the water-shed of the Fire Hole river. Whether Grand cañon existed in glacial times, I found no evidence to prove; but I am inclined to believe that it probably existed only in a rudimentary condition, and has been mainly excavated since that period.

From the evidence here cited, it is clear that the ice of the Yellowstone valley was more than that of a mere local or valley glacier. It was massive enough to fill up the main valley and override the surrounding hills, crossing minor water-sheds and spreading into adjacent drainage basins. From elevated points in the Yellowstone valley, the distant outlines of the Wind River mountain or their northward prolongation can be seen to the south-east, while southward rises the lofty peaks of the Tetons. That these mountains, though not within the present water-drainage basin of the Yellowstone, were within the ice-drainage of the ancient glacier of that valley, is, I think, extremely probable. The abundant blocks of granite and granitoid gneiss lying within the volcanic area of the Upper Yellowstone, seem to have been derived from cliffs outside the basin. Of course I had no opportunity of tracing them to their source. But I could hardly doubt that it will be found in the central archæan cores of these distant mountains. Should this view be confirmed, it will supply an additional proof of the magnitude of these ancient glaciers, for it will show that the snow fields of the Wind River and Teton ranges were so extensive that their ice rivers streamed northward across the buried water-shed, and poured into the basin of the Yellowstone. According to Dr. Endlich, the old glaciers on the west side of the Wind River mountains pushed their way out into the plateau country for several miles, and piled up moraines there to a height of 800 or 900 feet. It is much to be desired by all who take an interest in glacial geology, that an exploration should be made of the country lying in the Yellowstone valley northward into the area of northern glaciation within the British line. Such a survey will show whether there was any connection between the massive glaciers of the Rocky mountains and the great northern ice-sheet; whether the latter, as it moved down the valley of the Missouri, was swelled by the accession of ice-streams from these mountains. The main facts could be gleaned with comparative ease. The country, no doubt, is the haunt of Crows, Blackfeet, Gros Ventres and other Indian tribes who have recently shown little sympathy with the white man. But this is a difficulty which patience and tact would overcome. The geological harvest is ample, and only waits the advent of some bold and skilled observer.

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THE DISCOVERY OF IRON IMPLEMENTS IN AN ANCIENT MINE IN NORTH CAROLINA.

BY FREDERIC W. SIMONDS.

IN Western North Carolina are found many evidences of prehistoric mining operations, such as open cuts, tunnels, shafts and dumps. The latter are covered with a forest growth of several hundred years, and in the excavations has accumulated the débris of centuries.

About ten years ago a new industry was inaugurated in the State, that of mica mining, and strange to say, the best and most profitable mines have been those located upon the sites of the "old diggings." In clearing out the ancient works very few implements have been found which throw light upon the original miners. The opinion, now generally held, is, that they belonged to the Mound-builders, whose mounds are also found, but sparingly, in the river basins. That this is, for the most part, correct, I think has been clearly shown by Prof. Kerr in his Report on the Geology of North Carolina for 1875. He there states that he learned in a conversation with Col. Whittlesey, and subsequently from numerous publications on the subject of the mounds of the Northwest, that mica was of common occurrence in the tumuli of the Mound-builders, among the utensils and ornaments which such rude people are in the habit of inhuming with their dead owners. And upon further inquiry, he ascertained that cut forms, similar to those found in the mounds were occasionally discovered among the rubbish and refuse heaps about and in the old pits.[1]

When Prof. Kerr's attention was first called to these prehistoric excavations (1867), he was invited to visit some "*old Spanish silver mines*" which had been discovered a few miles south-west of Bakersville, in Mitchell county, showing that by some means the inhabitants had associated these works with the early explorers of our country. It seems probable that tradition may have given rise to this impression, for in a letter written by the Hon. T. L. Clingman, who is very familiar with Western Carolina, I find the following: "The old Cherokee Indians, living in some of the western counties, used to speak of a tradition coming down in their tribe, that long ago companies of white men came on mules from the south, worked during the summer and carried off a white metal with them."[2]

The evidence of the former exploration of this region by white men—Europeans—in search of the precious metals, has not, until recently, been very strong, although in many instances the works indicated a considerable skill in mining, and in a few cases marks have been found as if made by some metallic instrument.[3]

This summer, for the first time, I learned that some iron tools had been found in an old shaft in Macon county.[4] Upon inquiry, I found them in the possession of Mr. Albert S. Bryson, a merchant in Franklin, the county seat of Macon. From him and others I ascertained the facts here stated.

In 1875 the Guyer mica mine was opened on the site of a "prehistoric working" on the mountains near Iola creek, northwest of the town. There was a basin-like depression some eighteen feet in diameter, at the bottom of which was a shaft apparently about eight feet deep. In carrying on the necessary mining operations this old shaft was cleaned out and found to be of considerable depth. In the rubbish which had accumulated

[1] Report of the Geological Survey of N. C., Vol. 1, p. 301, 1875.

For the Finding of Mica ornaments in mounds see Vol. 1, Smithsonian Contributions to knowledge. Monograph of Squier and Davis, p. 240; and Foster's Prehistoric Races of the U. S., p. 191.

[2] Speeches and Writings of Hon. Thomas L. Clingman, p. 130.

[3] See Ib., p. 131.

[4] Since the above was written Prof. Kerr has called my attention to the fact that an iron crank was discovered some years since in an ancient shaft in Cherokee county, on Valley river. See Rept. of Progress N. C. Geol. Surv., 1869, p. 56.

PLATE I.

Ancient Iron Mining Implements in North Carolina.

within it, at distances varying from thirty-five to fifty feet below the surface, were found the iron implements figured in the accompanying plate. At the depth of forty feet an adit or tunnel was found opening on the mountain side, and at the bottom of the shaft (fifty feet), resting upon quartz, the charred remains of wood. It is thought that fire was here used for the purpose of breaking up the quartz; that after the rock was heated, water was poured upon it causing it to split into fragments. Now as to the implements. They are of wrought iron, and of such shapes and weights as to be easily carried. That they had been worn out and thrown away is not improbable. The axe (Fig. 1) is rather small, and has been considerably distorted by hard usage, as will be seen in Fig. 2. The eye is quite large, and the head is cracked completely through (Figs. 2 and 3). There is also a rupture near the blade as if the strain on the handle had been so great as to almost break away the side. On the blade is a brand (Fig. 1) which has been so effaced by erosion as to be no longer intelligible. The shape of this axe and its light weight are in contrast with those in use—being of an old pattern which is now rarely met with. The blade and head are each about three and three-quarter inches in width, while between them the width diminishes to two and three-quarter inches.

The implements represented in Figs. 4 and 5 are evidently a pair of gudgeons—parts of a windlass. They are pointed at their extremities that they may be driven into a wooden roller or axis. The lower part of the shank is squared so as to prevent its turning in the wood, while the upper part is cylindrical, forming an axle for the support of the roller. Into their bifurcated heads were undoubtedly inserted levers for turning a windlass. As these irons have a length of but sixteen or seventeen inches, they could be easily carried from place to place, and the machine of which they form a part, could be readily extemporized from the trunk and branches of a small tree. Fig. 6 is theoretical, showing their probable use.

A wedge three and three-quarter inches long and one and a-half inches wide, was also found (Fig. 7). Its head was somewhat battered.

The inference to be drawn from the discovery of these *iron* relics, is, that some of the "old diggings" are the work of Europeans, as the use of iron was unknown to the native American races. Is it not possible that there is a basis of truth in the old Cherokee tradition? That a party of Spanish explorers—and perhaps more than one—penetrated Western Carolina in search of gold, silver and other minerals, and, in some instances, finding the old mines of the Mound-builders, caused preliminary investigations of their value, does not seem improbable. In Cherokee county are found "prospect holes" excavated with far greater skill than that of savage or barbaric miners.[1] To what expedition these Europeans belonged, is a mystery. That of De Soto, according to the course traced out by Bancroft, passed within a comparatively short distance of North Carolina—especially the south-western corner—as it crossed from the head waters of the Savannah or Chattahouchee to those of the Coosa. From it an exploring party was sent to the north, which returned disheartened—without the precious gold—reporting the mountains impassable.[2] Could the work have been done by stragglers from this or other parties, or have there been special expeditions to this region of which the historian has lost sight?

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ON THE FERTILIZATION OF CALAMINTHA NEPETA.

BY WILLIAM TRELEASE.

DURING the past summer my attention was several times drawn to this little plant, in the vicinity of Washington, by the large number of insects collected about the flowers, and a more careful examination revealed the following facts about the species.

The stem, leaves, calyx and corolla are furnished with a fine pubescence, which may prevent small and undesirable insects, like ants, from wandering over the plant, for a coating of this sort often proves insurmountable to these tiny creatures. In the throat of the persistent calyx is a whorl of stiff hairs that may serve as a protection for the young corolla and the essential organs before they are protruded from the calyx; and after the

[1] One of the most remarkable of these is a *timbered shaft* 100 feet deep on Valley river. See Rept. of Progress Geol. Survey N. C., 1869, p. 56.

[2] History of the United States. Bancroft. 13th edition. Vol. 1, pp. 47–48.

corolla has fallen away, the maturing ovary may likewise, perhaps, be protected against certain enemies.

A well developed fleshy outgrowth of the receptacle secretes an abundance of nectar which collects about the ovary in the lower part of the flower.

The lower lip of the corolla, near its base, is sparsely beset with long, stiffish hairs (*h*). Two large purple spots on its middle

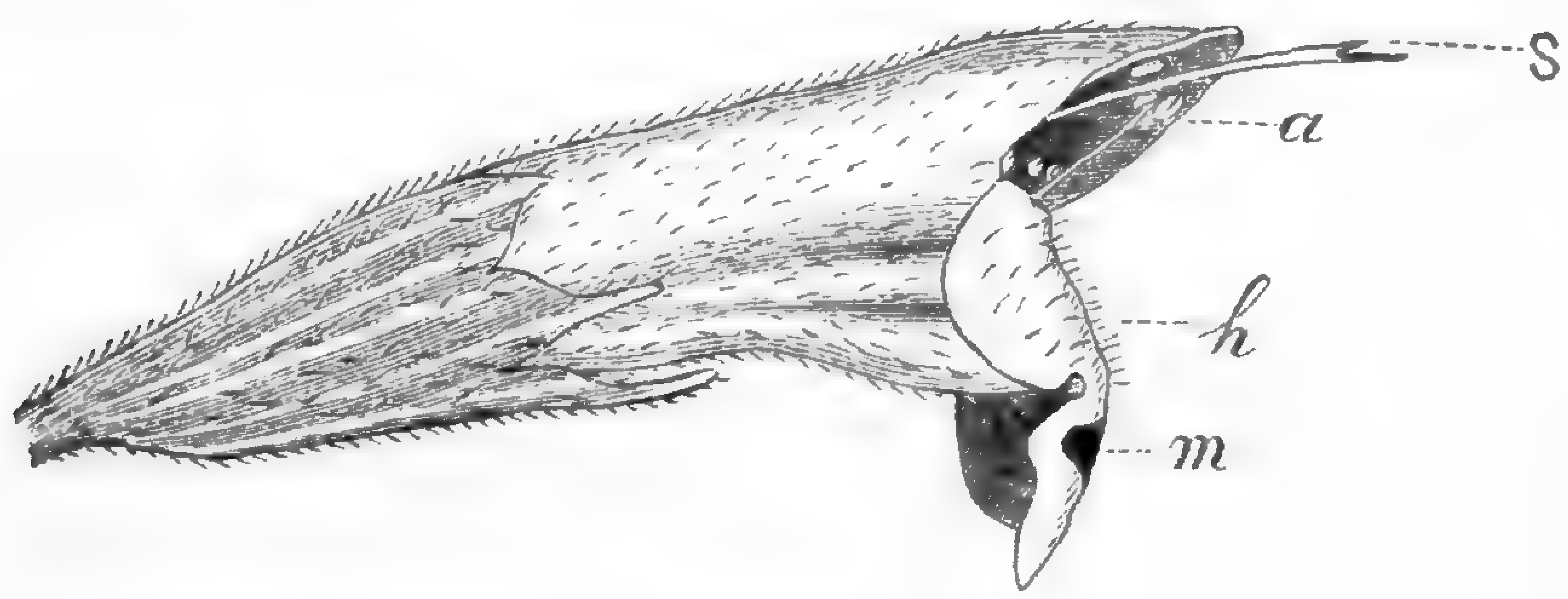


FIG. 1.

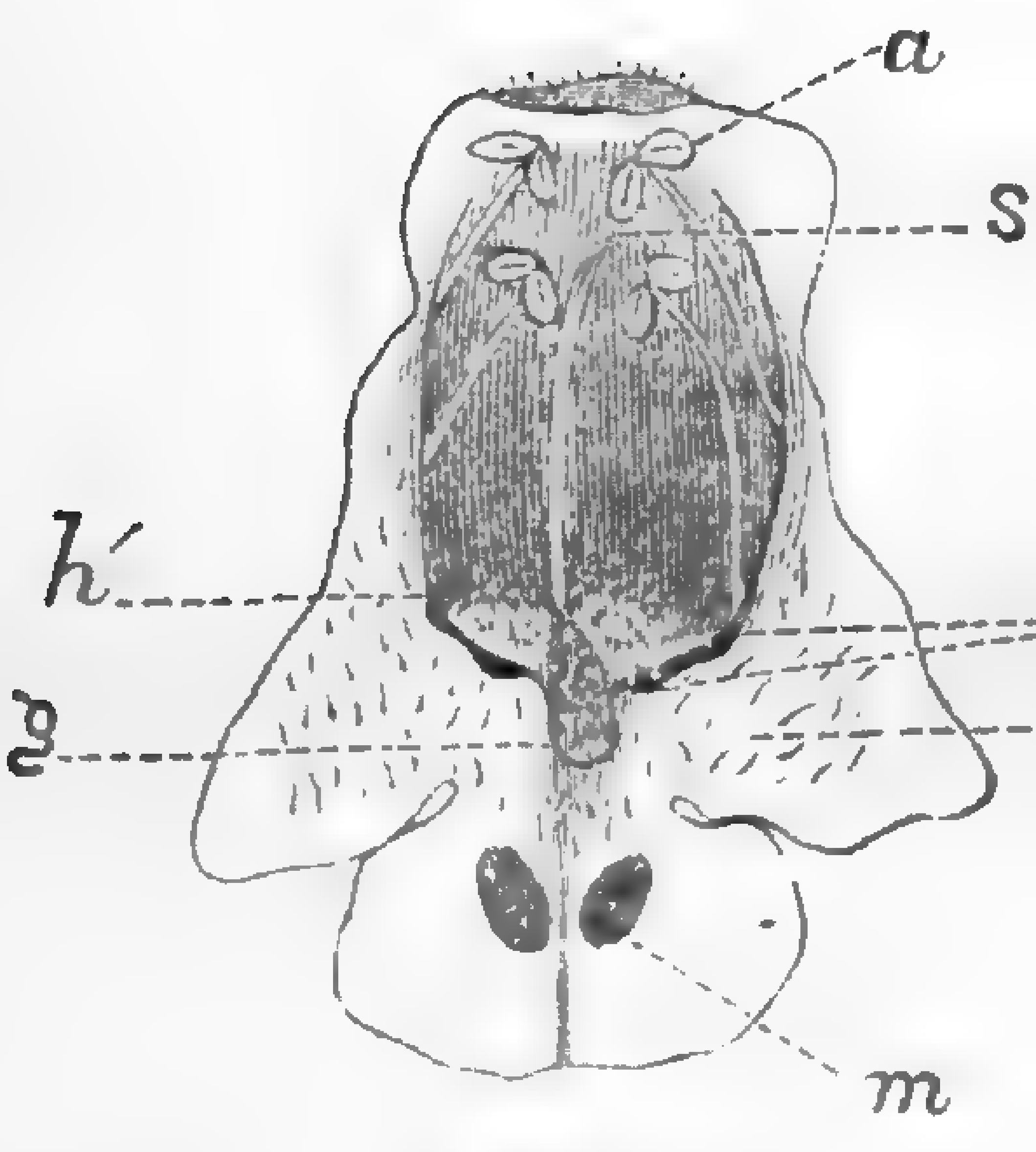


FIG. 2.

FIG. 1.—Old flower of *Calamintha nepeta*, seen from the side. FIG. 2.—Younger flower from in front. The figures are enlarged seven diameters; *a* indicates the anthers; *g*, the guiding groove; *h*, the protecting hairs of the lower lip; *h′*, the ridges of hairs bordering the guiding groove; *m* and *m′*, the nectar marks; *s*, the stigma.

lobe and close to the median line (*m*), and several smaller ones (*m′*) at the mouth of the corolla tube, clearly indicate the way to the nectar concealed within, while a deep guiding groove (*g*), bounded on either hand by ridges of stiff hairs (*h′*), leads directly beneath the four anthers (*a*) that converge in pairs close beneath the upper lip of the corolla.

On the expansion of the flower, the anthers shed their pollen. At this time the style is of such a length as to bring the stigma into the middle of the quadrilateral whose angles are occupied by the anthers, but its two lobes (Fig. 2, *s*) are now closely pressed together, and immature. In this stage the flower is, therefore, staminate, only, as regards function. After the unfolding of the corolla, the style gradually elongates and its summit passes close below the outermost pair of anthers, even brushing them in many instances; but very little pollen seems to be carried away by the still appressed lobes of the stigma. When the latter has become somewhat exserted (Fig. 1, *s*) its lobes expand, and are now ready for fertilization, and as some pollen still remains in the anthers, the flower is now properly hermaphrodite or perfect. The stigma, however, retains its freshness for some time, and meanwhile the remainder of the pollen may have been removed, leaving the flower pistillate in function.

If, now, an insect in search of nectar is attracted to the flower, the purple blotches or nectar marks catch its eye and lead it directly to the mouth of the corolla, its head or back usually coming in contact with the receptive face of the stigma if this is already mature. The dense *chevaux-de-frise* of hairs, however, prevent it from entering unless it be large enough to effect the transportation of pollen in return for the food obtained; but if sufficiently large and strong to pass these, and not too large to creep into the flower, it enters, finding it far easier to follow the guiding groove than to pass over the bristles on either hand. Pushing in a sufficient distance to obtain the desired food, its back rubs against the anthers, or what is equally effective, its sides shaking the filaments, bring down a shower of pollen. Having exhausted the supply of nectar in the first flower, it flies to another, then to a third, carrying pollen from one to the other. Several species of Halictus[1] and *Calliopsis andreniformis* Sm., were seen to visit the flowers in this manner.

If, on the other hand, the insect be too large to force its way into the corolla, it alights on the lower lip, usually clasping the side of the tube with two or more of its feet, and thus steadying itself, while its head is thrust into the flower as far as possible, and its tongue is extended to reach the nectar. Though the *modus operandi* is different, the result is the same as in the last case, with an exception which will be mentioned later. The flowers are visited in this way by the following insects: Hymenoptera—*Apis mellifica* L., *Bombus virginicus* Oliv., *B. fervidus* Fab., *Xylocopa virginica* Drury (♀ and ♂), *Megachile brevis* Say, *M. latimanus* Say, *Anthidium cognatum* Cres., *Ammophila vulgaris* Cres., *Bembex fasciata* Fabr., and *Myzine 6-cincta* Fabr. Lepidoptera—*Colias philodice* God., *Pieris rapæ* L., *P. protodice* B. and L., *Papilio asterias* Drury?, *Junonia cœnia* B. and L., *Hesperia hobo-*

[1] The Hymenoptera were all kindly identified by Mr. E. T. Cresson.

mok Harris?, *H. tessellata* ?, *Lycæna comyntas* Harris?, and two species of Nyssoniades. Coleoptera—*Chauliognathus pennsylvanicus* DeGeer. In addition to these a fly, *Mesograpta marginata* Say.,[1] and one of the species of Halictus mentioned above, were found in considerable numbers collecting pollen from the anthers of young flowers, in doing which they undoubtedly often carry the pollen of one flower to the stigma of another.

Of these insects the species most common in this connection are *Apis mellifica*, *Bombus virginicus* and *Chauliognathus pennsylvanicus*, all of which may be counted by thousands on a bright sunny day about the first of September in places where the plant grows abundantly; and it is upon them, chiefly, that the fertilization of the flowers is dependent. Some of the Lepidoptera, especially *Pieris rapæ*, are very often seen sipping the nectar of the basil thyme, but from the length of their proboscides they can easily reach the bottom of the corolla without inserting their heads into its throat, and I am inclined to believe that their efficiency in the transfer of pollen is not very great. A noctuid moth, apparently belonging to the genus Prodenia was also very abundant, but in obtaining the nectar it did not rest upon the flower like the species enumerated above, but hovered before it, steadying itself with its fore feet as I have seen *Heliothis armigera* do when feeding upon the involucral nectar of Gossypium. Though I was somewhat surprised to find a noctuid thus engaged at midday, I find that Harris[2] records the habit as not uncommon to certain Agrotids, and it is probably well known to all entomologists.

From what precedes, it may be seen that the nectar of this Calamintha attracts many insects belonging to a considerable number of species, and that the majority of these—in individuals if not in species—readily obtain the sugared fluid, in doing which they encounter the stigma and anthers of the flower—the former (if mature) in entering, the latter before leaving it.

The development of the flowers is such that the self-fertilization of a given flower appears possible in but two ways: 1. Pollen may be taken up by the longer (lower) lobe of the immature stigma as the latter passes below or between the anthers during the elongation of the style, and remaining there, and

[1] Identified by Mr. Edward Burgess.

[2] Insects Injurious to Vegetation (Flint edition), p. 441.

retaining its virility till the stigma matures, it may then emit its tubes and fecundate the ovules. 2. An insect dusted with the pollen of a flower may revisit the same flower, leaving some of its burden on the stigma; or it may possibly deposit freshly gathered pollen on the stigma as it leaves the flower, but from the position of the stigmatic surface this is not likely to happen. Ordinarily, however, any flower will be fertilized by pollen from another, though from the irregularity with which insects visit the flowers of these straggling plants, this is as likely to belong to the same stock as to a different one.

In closing, it may not be out of place to offer a brief comparison of this species with others of the large family of mints to which it belongs. In this order, nectar is usually secreted—as in the present instance—by a prominent gland that, closely adjoining the ovary, is usually more or less prominently four-lobed, portions of it filling the angles between the lobes of the latter organ. Proterandry, or the maturity of the stamens before the pistil, is the rule, and is sometimes correlated with motions, due to the growth of the parts, by which the anthers and stigma at maturity successively occupy the same place with reference to the other parts of the flower. In some cases strongly marked proterandry, leading to invariable cross-fertilization, has caused the origin of forms with smaller flowers in which the anthers are entirely abortive, so that the species becomes gyno-dioecious. This is the case, for example, with the related *Calamintha clinopodium*.[1] But a careful examination of the species under discussion did not reveal a similar peculiarity in this case, though further observation, and especially over a more extended territory, may, perhaps, reveal something of the sort. According to Dr. Müller, l.c., *C. clinopodium* is visited for its nectar by two lepidopterous insects, *Pieris brassicæ* L., and *Satyrus hyperanthus* L.; and *Calamintha acinus* is visited for nectar and pollen by the hive bee, and for nectar by a bombyliid fly, *Systeochus sulfureus* Mik. From the floral structure of the basil, which is quite common in parts of our own country, one would expect its most frequent visitors to be Hymenoptera, and this is supported by what we know of the visitors of *C. nepeta*; and if so, it is probable that careful examination where numbers of the plants grow in company will reveal the hive bee as among the more frequent.

[1] Dr. H. Müller, Befruchtung der Blumen, 1873, p. 325.

COMPARATIVE NEUROLOGY.

BY S. V. CLEVENGER, M.D.

WHAT can we say of the nervous system of Protozoa, but that it exists in a diffuse undifferentiated state? If we speak of a nerve force it implies the existence of a nerve, and herein we have the mystery explained. I do not believe in a nerve force after the general acceptation of the term, as a sort of aura residing in and produced by nerve cells. Let us see how much a reconstructed view will account for the hitherto unaccountable. There are certain natural "forces" or vibrations of matter, called sound, heat, light, electricity, etc. Expose albumen to the influence of any or all of them and determinable motions are produced in its mass. Protoplasm has a definite molecular composition which never fails to be susceptible to these influences. The contractile phenomenon is not a whit more of a mystery than the beautiful laws of electrodynamics as deduced by Ampère from the fundamental experiment of Œrsted: I. *Two currents which are parallel, and in the same direction, attract one another.* II. *Two currents parallel but in contrary directions, repel one another.* To demonstrate this, one current should be fixed and the other movable. In a few words the Amœba is the medium for the movable current while its pabulum is equivalent to the fixed current which attracts the animal. I do not mean to lay this down as actually the case, for the causes of Amœbic movements are multiplex, from which, as might be expected, there would be multiplicity of changes in its sarcode. But this alone would indicate how sufficiently the laws of physical forces may some day go to explain the protoplasmic motions.

We see that all matter is mobile. The molecules of the Amœba are not force proof, and these forces would, from the very homogeneity of the mass, pass in varying directions through the animal as governed by extrinsic causes. But as soon as differentiation began, by even as simple a process as an induration of one part of the protoplasm, currents must be deflected from their former courses. Huxley considers Kleinenberg's fibers of the Hydra as internuncial, and hence the primary form of a nerve. In this case we have a contractile muscle with a nerve differentiated from, and continuous with the muscle. How has this come about?

Immediately upon the definite location of tissue which is more susceptible to certain external influences, such tissue would quickly differentiate a portion as the path of least resistance, which would also be the most direct conductor of motions from without to the contractile part. Thus the neuro-muscular cells of Hydra appear. From the general mass proceeds the ectoderm, and from it is differentiated the nerve-muscle tissue.

The causes of this differentiation may be conceived by regarding the forms assumed by a layer of the sporules of Lycopodium and sand, when this mixture is subjected to vibrations coarse enough to affect the layer. *The electro-dynamic law which draws together matter transmitting currents in one direction would of itself construct a nerve path to contractile tissue.*

A nerve, then, is internuncial only, and the ganglion cell is histogenetic. Neither have any force-producing power, but are both the media through which certain molecular vibrations are most swiftly transmitted.

The primitive sense is tactile and all senses have proceeded from its differentiation.[1] For illustrative purposes let us consider energy as divided into molecular vibrations, from one ethereal pulsation in an eternity, to an infinite number of vibrations in one second. In such an undulatory series we may see, as a small division of it, all forces from sound to gravitation represented. While the protozoön may be visibly affected by every such undulation, the homogeneity of its composition prevents any differential response; for instance, the tremor of a musical note, heat, light, electricity, alike produce contractions or expansions (motions) of its mass. In a higher form of life nerve tissue appears, which conveys only certain vibrations and rejects all others. Take one undulation in a second as the capacity of this nerve fiber. It is a tactile nerve. When a nerve fiber conveys more rapid undulations differentiation begins. Sixteen to forty thousand per second begin and end the auditory vibrations. Quicker vibrations to four hundred and fifty billion per second we may view as heat appreciation, thence to eight hundred billion from red to violet light, above this fluorescent undulations, "chemical energy," electricity, to infinity. We may thus mathematically conceive an

[1] In a paper read before the American Association for the Advancement of Science, Boston, August 28th, 1880, published in full in the Journal of Nervous and Mental Disease for October, 1880, I treated this subject more with reference to the microscopic anatomy of human nerve systems. Extracts, as above, made from that paper are such portions as refer more directly to our present subject.

auditory sense derived from the general tactile or a special touch sense (like that of the fifth pair of nerves). An optic sense would arise from this same tactile, and we have seen it thus differentiated embryologically.

Qualitative differentiation of the nervous organization proceeds dorsally, with a tendency toward the head end. That portion of the animal which stands in most direct relation to the changing molecular movements of the environment develops the highest sensory and motor nerve-centers and projections.

Repetition of parts of a system, up to a certain point ceases; and these parts become commissurally united before another system is perfected.

The sympathetic nervous system, consisting of the intestinal and vascular or vaso-motor nerves, develops first. Blending the results of comparative embryology and anatomy, the sympathetic precedes the creation of other systems.

The second system to appear phylogenetically is the spinal, equivalent in the Invertebrates to their "cerebral" ganglia.

The third system is the intervertebral, the swellings upon the posterior roots of the spinal nerves.

The cerebellum is formed from fused hypertrophied intervertebral ganglia.

Many sensory cranial nerves pass through this organ and by the fusion of these originally separate centers coördination occurs necessarily.

Excessive development on the one hand, or want of development on the other, places all the ganglionary tubercles and lobes of the encephalon in the third system category. Thus *the præ-frontal lobe of the cerebrum, the occipital and temporal lobes, the olivary body, the olfactory lobe, the mammillary eminence, the epiphisis cerebri, the tubercula bigemina, the petrosal and Gasserian ganglia were originally intervertebral ganglia*, and still maintain resemblance to these ganglia in many particulars.

The præ-frontal lobe is the last intervertebral ganglion to develop. It grows larger in the scale of intelligence and presses the occipital (see the brains of monotremes and marsupials) backward, downward and forward, thus forming the temporal (or what has been erroneously termed the middle) lobe.

The cerebro-spinal nerves, in some cases, preserve their original projections from and to muscles, but these nerves may also have not only a distribution to the viscera, as has the pneumogastric, but may also project into and from *other system-centers.* The lateral columns of the spinal cord, the tegmentum and crura cerebri in their main mass may thus be regarded as cerebro-spinal nerves of the highest series, having lower system-centers for peripheries. The præ-frontal lobes thus exert an inhibitory control over the highest centers, because such centers are peripheries for the nerves of these foremost ganglia.

We accept the motions of protoplasm as evidence of life, and yet ungrouped elementary atoms are subject to the play of physical forces, which become known as modes of motion: sound, heat, light, electricity, etc., through the changes in place of atoms and molecules.

Inasmuch as sensations have for their ultimate expression motion in the living organism, cause and effect exchange places in the recognition that forces are manifest to us as sensation only in the molecular movements caused by forces. These molecular movements impress us as sensations which, of necessity, must be translated into some form or forms of motion.

Sensibility and motility, then, are sequentially convertible terms, and we find it none the less true in the most complex than in the simplest forms of life.

There are certain fundamental considerations which should stand in axiomatic relation to all biological inquiries.

1st. Sensibility and motility are merely afferent and efferent terms to express the effects of force upon matter and matter upon force.

2d. In life a primary object of motion is for procurement of food.

3d. Growth depends upon proper nutrition (ingestion).

4th. Multiplication (as fission) proceeds from growth.

5. Food is any material, gaseous, liquid or solid, which tends toward nutrition of the body.

6th. " Development is a process of differentiation by which the primitively similar parts of the living body become more and more unlike one another." (Von Baer.)

7th. " Higher sensory organs are special elaborations with one special function capable of response to stimuli of one special kind. They are developed from the lower kind of sensory organs, and oftentimes still possess the essential structure of that lower kind." (Gegenbaur.)

As illustrative of undifferentiated faculties it may be mentioned that by the Gregarinæ food is taken in by endosmotic processes at the surface. Any place in the protoplasm can act as a digestive cavity by enveloping and absorbing nutritive matter.

It is the simpler view, entertained by some (in opposition to the delamination precedence theory), that the form which preceded the gastrula was a one-layered vesicle which, by invagination, produced the endoderm from the ectoderm. While the ectoderm was undifferentiated, all parts of the cell were assimilative. In the gastrula stage the endoderm acquired specific ingestive faculties. Differentiation of the purely ingestive proceeds thus from the intestine, while the ectoderm remained in contact with the more variable conditions of the environment, and developed the greatest qualitative sensory and motor organs. The entire nervous organization, in its earliest condition, answers to that portion which, in Vertebrata, presides over the vermicular motions of the intestines, and the correlated respiratory and circulatory structures—the sympathetic nervous system. This, therefore, we may entitle the First System. As soon as the enteron is created, by folding in of the ectoderm, qualitative development of this First System is restricted to such functions as are more clearly nutritive, as, when the blood vascular system is differentiated from the mesoderm, the vaso-motor nerves are derived from or added to the sympathetic, and exactly in the ratio of development of the viscera so does the First System differentiation proceed.

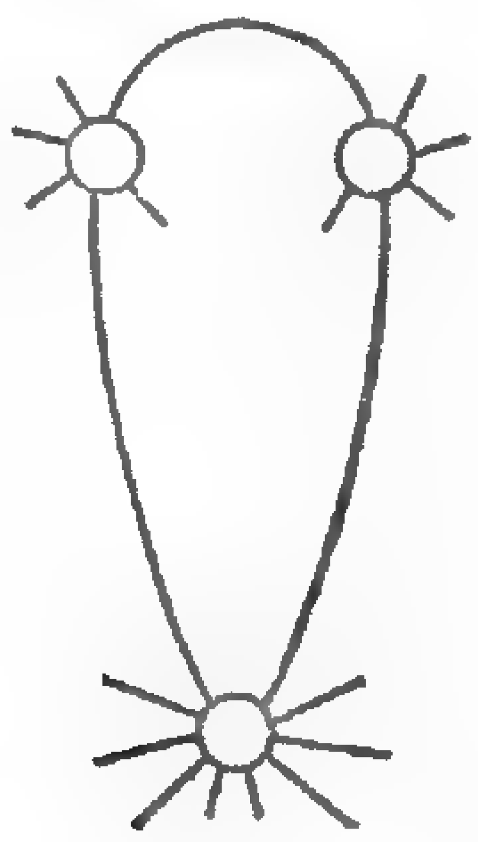
In high forms of Invertebrata, but more pronounced in Vertebrata, the viscera, and consequently the First System of nerves, occupy an inferior position, properly termed ventral, while as a broad rule the upper surface of the animal comes most in contact with varying molecular motions of the outer world. Hence, we may say that it comes to be a law, that from the dorsal to the ventral parts of the animal, ingoing impressions proceed, and, of necessity, progressive development must occur, by superimposition upon the ventral system.

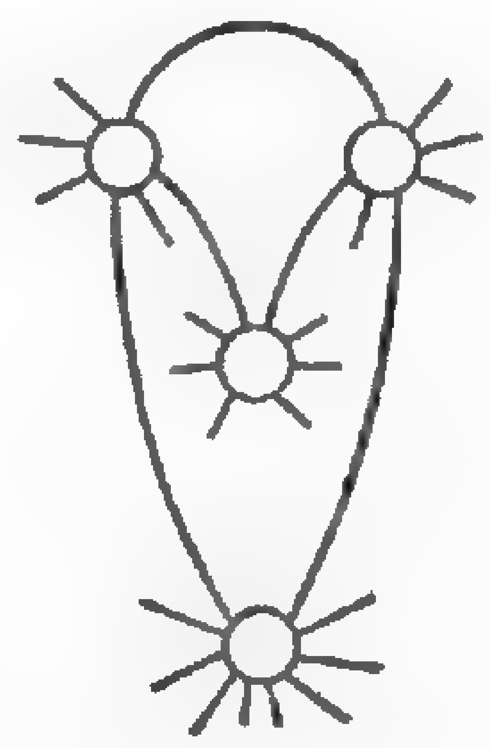
The first appearance of a Second System, equivalent to the spinal cord (segments coalesced) of Vertebrata, is indicated in ganglionic enlargements upon the afferent nerves of the First System.

This is apparent in the oyster, whose anterior ganglia (A) are placed upon the fibers leading to the principal ganglion of the body. (In a typical embryonic, not phylogenetic sense, for the oyster is a degraded Lamellibranch.)

This appears to be a specialization of the tactile sense, with reference to its uses anteriorly in food discrimination and ingestion, involving ciliary prehension and control of the valves. In Pecten further quantitative development of a Second System produces the pedal ganglion (C), also related to the touch sense.

A





C

The cilia of Protozoa subserve ingestive as well as locomotor purposes, and show the relationship of ingestive and general motions, and that the locomotor ability is often derived from the prehensile ingestive. In the free Rotifer this is quite apparent.

As the segments increase the sub-œsophageal ganglia multiply; the first set of ganglia become relatively ventral and preside over nutrition, while the second set, relatively dorsal, indicate progressive differentiation, as control of a pedal extremity or some special organ related externally. At the same time this dorsal ganglion is connected always with the ventral system. Fusion of these segmental ganglia with each other, or with ganglia of other systems, produce confusing appearances. This fusion of systems is most clearly seen in Vertebrata.

The vibrating molecules which produce the undifferentiated impressions upon lower Protozoa may be considered as causing purely tactile excitation. Just as the waves that dash the primitive animal about differ from the ripples that bring it food, only in degree, so the differences between impressions must be regarded. All sensation being related to molecular motions, and all special sense organs being derived from indifferent primaries.

Otocysts in their simplest form are connected directly with nerves, as are the pigment granules which eventually develop into eyes. Prof. Alf. M. Mayer shows that the fibers of the antennæ of the male mosquito vibrate sympathetically to the notes of the female mosquito, and that the vibrations of the insect's antennæ may teach it the direction of sounds (thus allying this sense to the so-called "space sense" of the human labyrinth). Prof. Mayer also announced that the terminal auditory nerve-fibers vibrate half as often in a given time as the membrane of the tympanum and the ossicles.

In these instances there is a direct derivation of an auditory from the special tactile which, in turn, was evolved from the general tactile sense, and does not seem to be lost, even in man, as a property of sensory nerves.

A heat sense system of nerves developed from pigment terminals, by further elaboration could become ocelli and finally eyes.

A special series of nerves for heat appreciation would have necessarily *a general distribution throughout the body*, to viscera as well as to more external peripheries.

Nervous tissue appears at the same time as muscular, and affords a better path or course of less resistance for the molecular vibrations from without. The muscular is a definitely located expression of what previously belonged to all parts of the animal, contractile ability or motility for assimilative purposes.

This assimilative faculty is essentially prehensile, and in the word prehension we may grasp the idea of a differentiation of such faculties as respiration, locomotion, deglutition, etc.

Carrying the comparison from Protozoa to man, all that man does or may hope to do has for its basis the single fundamental, though widely differentiated faculty of prehension.

Jaws and arms are prehensile, clearly. Ribs are prehensile in the sense that they assist in prehension of oxygen (food) for the lungs, morphologically and less physically in man, while in Ophidia the ribs are locomotory prehensile, direct.

Legs are prehensile directly in quadrumana, and in man in carrying him over ground in search of food.

As mentioned, the next step in development of the nervous system is when the ingoing general impressions become specialized and a secondary ganglion appears upon a sensory strand of the primary, which signifies that from among the general impressions some one sense, as sight, is being specialized. This is outwardly evidenced by formation of ocelli or eyes (leech), which require a special projection.

By quantitative increase multiple eyes may form (leech) and these become united into bilateral organs (pyramidal fusion in crayfish).

The likeness between the chain of ganglia in the leech and the spinal cord of Vertebrata has led many comparative anatomists astray in homologizing. A nearly similar chain of ganglia obtains in Vertebrata but situated ventrally from the vertebral column. This chain is a first system. The head ganglion, only, of the leech, as in most Invertebrata can be compared to a spinal. In Insecta and Myriapoda the superimposed secondary becomes more evident. An "unpaired system" runs in the median line between and connected with the paired or primary system, typifying the more definite appearance of the medullary gray and its commissures below or back of the head.

Todd and Bowman (pages 611 and 614, Vol. III) use the following words, which indicate an early recognition of the anatomical fact without their having seen its connection or full import: "In the bee the cerebral ('secondary') ganglion is very large; from its anterior portion is given off two nerves which pass forward to the base of the antennæ and have their origin well marked by a distinct ganglionic enlargement!"

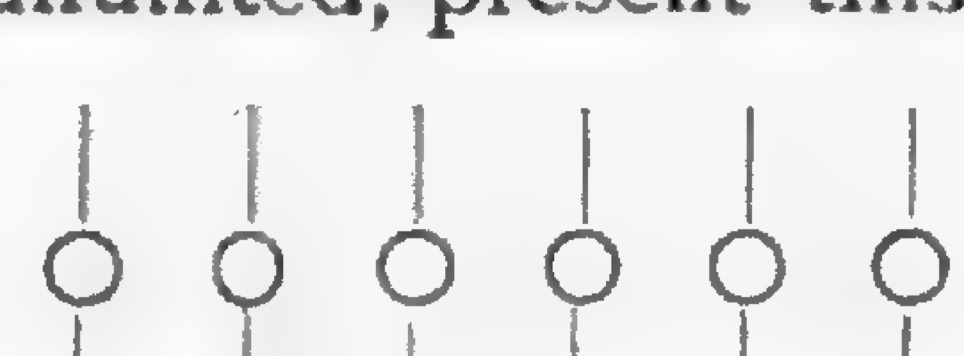
Todd dwells upon the importance of recognizing this distinct ganglionary enlargement, and repeats, "The sensory nerves have ganglionic enlargements in the bee."

(This appearance of a third system is rare in Invertebrata, though the crab and Pterotrachea also may prove to be its possessors.)

The ganglionic swellings which on the sensory nerves of the bee distinguished it from most Invertebrata, in vertebrate types from Cyclostomes upward become more markedly developed.

While both the first and second systems possess recognized afferent and efferent fibers, before being able to comprehend the relationships between systems or the process of projection formation, we must consider whether some fundamental law does not underlie these series of relations which will better account for their creation.

The typical segment is an animal whose nerve center lies midway between an afferent and efferent strand, thus: . A series of such segments, if ununited, present this appearance:



These segments could be correlated by a second fiber, which instead of passing between peripheries as in the instance of non-union, unite the segmental ganglia by making another ganglion its motor projection.

Carpenter (" Principles of Comparative Physiology," p. 642) expresses this view: " When different organs are so far specialized as to be confined to distinct portions of the system, and each part consequently becomes possessed of a different structure and is appropriated to a separate function, this repetition of parts in the nervous system no longer exists; its individual portions assume special and distinct offices, and they are brought into much closer relationship to one another by means of commissures or connecting fibers, which form a large part of the nervous system of the higher animals. It is evident that between the most simple and the most complex forms of this system there must be a number of intermediate gradations, each of them having a relation with the general form of the body, its structure and economy, and the specialization of its distinct functions. This will be found, on careful examination, to be the case; and yet, with the diversity of its parts as great as exists in the conformation of other organs, its essential character will be found to be the same throughout."

Segmental union, thus, is accomplished through efferent nerves no longer penetrating to primary organs, but passing to nerve centers of other segments, for the purpose of producing coördinated movements, and consequently to exert an inhibitory effect thereupon.

[*To be continued.*]

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BOTANIZING ON THE COLORADO DESERT.

BY EDWARD LEE GREENE.

II.

BETWEEN Coyote Wells and the next station lie some twenty-two miles of almost uninterrupted plain. The white clay soil, strong with salts and alkalies, produces no cacti, but there is great abundance of chenopodiaceous shrubs, popularly called grease wood. Yet there is no verdure even here; for although the grease bushes, contrary to the rule of desert growths, are leafy, their abundant foliage is of precisely the same dull whitish color as the clay in which they grow. Over this smooth and slightly yielding clay the walking was very easy, and I made good time, for as the objects of interest on this particular day's march did not promise to be numerous, I intended to shorten as much as possible the hours of inevitable suffering from thirst.

During the first half of the day a mirage, like a narrow sheet of placid water, just far enough away to dazzle and pain one's eyes, kept always its allotted distance ahead. By the wayside and over all the plain, were scattered the shells of a certain fresh water mollusk of the genus Unio. The nearest stream is the Rio Colorado, full a hundred miles distant, and these shells, now more than half dissolved and crumbling into scaly purple fragments when you touch them, must have been deposited here at a time when the Colorado had flooded the whole desert. No flower or bird or insect were seen to-day to vary the monotony or break the silence. At noon I detected the shape of an adobe hut upon the tremulous horizon away to the left of the stage road, probably a mere ruin, but nevertheless suggestive of water, since no one ever built an adobe wall in this wilderness without first having found water. The first impulse was to turn aside and visit the spot. But as, through the varying medium of the heated air, the adobe at one moment seemed near, and the next very far off, so that I could not guess whether it was one mile away or five, I at second thought resolved not to waste time in what might prove a long and worse than fruitless deviation from my proper course. Before the afternoon was half gone my twenty-two miles journey was ended. I had reached the station of Indian Wells. The third day's travel witnessed another change in the character of the soil. The ground becomes sandy, and instead of the grease wood of the alkali flats we have the much more sightly creasote bush (*Larrea mexicana* Morie), a bright evergreen with small foliage somewhat resembling that of the dwarf box, though the shrub has nothing of the close, compact habit of the box, and its slender spreading or rather drooping boughs bear yellow blossoms among the leaves.

The twigs when bruised exhale a strong odor of creasote, and they have stimulating properties. The Indians and Mexicans journeying across these parched wastes, chew them, and even tie bunches of them to the bits in the mouths of their ponies with good results in cases of extreme suffering from fatigue or thirst. This shrub occupies the sandiest parts of the desert, and usually where it occurs no other species of vegetation is found.

After some eight or ten miles of sand came another change of soil, and the creasote bushes gave place to the mezquit, a small tree of considerable importance in the Southwest. This was the first mezquit wood I had ever seen; I therefore turned aside from the road to walk among the trees, wishing to inspect somewhat carefully the characteristics of the species. Very suddenly my attention was called to certain objects interesting in quite a different way. The noonday silence was broken by a shout, and turning toward the quarter whence the voices had seemed to emanate, I discovered a dozen naked savages, some standing, others sitting under a mezquit tree. After a little experience of travel in Western wilds, one learns not to be always afraid of Indians; yet I confess on this particular occasion a full inventory of the traveler's feelings might have shown some fears. I was alone, unarmed, and at a rather unsafe distance from any habitation of civilized men. If the barbarians should, for any purpose, see fit to make away with the defenceless saunterer, and put his bones to rest beneath the sands, they could do so with perfect safety to themselves. They were stalwart fellows, quite different in appearance from the members of any Western tribe with which I was familiar; moreover they had displayed unusual boldness in their yelling out and commanding me, as they did by word and gesture, to leave my own course and come and pay to them my respects. But whoever upon finding himself in the power of savages feels any timidity had best conceal it. I, therefore, with an air of calmness and confidence marched forward and seated myself in the sand in the midst of the swarthy group. For a while no one spoke. Indeed, their knowledge of the learned languages was presumably not much more extensive than mine of the dialect of the Yumas. But the Yumas have inquisitive eyes, and they studied their visitor in silence. Presently the oldest looking one among them discovered something which evidently interested him. It was a plain heavy ring, rather specially valuable to me as having been made from a nugget of Australian gold which a friend from that far off southern coast had given me. The Indian pointed to this and asked if it was "oro."[1] Feigning a confidence which I was far from feeling, but judging it the wisest thing to do under the circumstances, I slipped the ring from my finger and passed it over to him. He placed it upon the

[1] Spanish for gold.

palm of his hand and gave it a slight toss in the air, thus testing to his own satisfaction its weight and genuineness. Each one of the speechless company went through the same performance, and then the ring was handed back to me by the one who had first received it, greatly to the quieting of my nerves. And now my botanist's portfolio had to be examined. It was well filled with flowers, and boughs and twigs of desert bushes, with which my interviewers were familiar. They all gathered close about me to admire my herbs, and then entered into conversation among themselves, discussing, I dare say, the question of my object in gathering up these things. They gave me their names for certain of the plants and then inquired what I called them. Presently he who seemed the chief man among them expressed to me his opinion that I was a "medico," and I felt that I was safe. Composedly I now surveyed the persons of these representatives of a tribe that was new to me. In appearance they were the least repulsive of all the Indians I had ever seen. Every one of the party must have measured at least six feet in height; and clad only in their breech clothes, each displayed a development of form and figure well nigh faultless. Their faces, too, really bore an expression of mildness and good humor not commonly noticeable in aboriginal Americans. In short, I beheld for the first time a group of rather handsome Indians. What their business may have been here in the midst of the desert, so far from their homes on the fertile banks of the Colorado, I cannot guess.

To-day the distance from station to station was thirty-two miles. Happily for the pedestrian there is a well mid-way between the stations. This place of refreshing was arrived at within a half hour after I had concluded my visit at the encampment of Yumas. It is called New River Well; not because there is any river there or ever was. There is, however, a broad and shallow channel where once, since white men began to traverse the region, there flowed for a few hours a broad and turbid stream. Though the flood was transient, and no one could tell whence it came, the fact sufficed to give the place the name of New River. A deep well has been sunk at this point by the stage company. The water, though clear and cold, has such a sweet, nauseating and rather metallic taste that no one drinks of it unless impelled by most inordinate thirst; however, it does not seem to be at all unwholesome. There is no describing the almost maddening thirst which is excited by a half day's walk under a scorching sun in this excessively dry atmosphere; but from the incredible quantity I drank of this water, so offensive to the palate, I suffered not the slightest inconvenience afterwards.

From New River we pass forth again to a dreary stretch of sandy waste. Heaps of white bones half buried under sand drifts by the wayside, mark the point where years ago a large herd of beef cattle perished in the attempt to drive them by this road from the rich grassy valleys of Sonora to the commanding markets of the Californian coast. The afternoon heat was intense, and one felt more than willing to pause and rest a while as often as one found a creasote bush tall enough to give a little shade. Owing to the several delays made during the day, the deep evening shadows, as they fell, found me some miles from the station; but the road being clearly traceable, there was no danger of missing one's way, and the walk by starlight, in the cooler air, was not unpleasant. As I entered now another belt of low mezquit wood, the light evening breeze came laden with delightful perfume very much like that of pond lilies. But for the loose, dry, yielding earth beneath my feet I could, in the darkness, have fancied myself near the margin of some far northern lake in June, when thousands of those queenly flowers rest on the bosom of placid waters, and breathe "sabean odors" on the air of night. From thoughts of distant lands, and memories of "days that are no more." I was called back to the present by the significant and just now not unwelcome sound of a bull dog's bark, announcing the proximity of my place of shelter for the night, or at least of what I had looked forward to as such; but in fact, this one particular station, when reached, appeared so filthy and ill kept that I was loth to accept a lodging under its roof. After supper as I sat outside the door, I descried, by the light of the rising moon, some bales of hay near the stable, and, as the night air was mild, I asked and readily obtained permission to sleep on a bale of hay. Here I lay, wakeful for a long hour, watching by the moonlight the gambols of a wolf from the desert. This frolicsome beast amused himself and me by capering and yelping around the chained watch dog, greatly to the annoyance of the latter, who evidently wished himself free for a good chase or a fair fight.

In the early morning search was made for the flowers, whatever they might be, which had breathed forth such grateful incense on the evening air. They were not soon discovered. The parched earth showed nowhere grass or herb of any sort. One cottonwood which the ranchman's axe had spared, stood fair and bright in its fresh spring foliage; but the mezquit trees, notwithstanding the high temperature of these latter days of February, showed yet no sign of leaf or blossom; the larger of these, however, seemed burdened with heavy tufts of a dark green parasite —a species of mistletoe (*Phoradendron californicum* Nutt). This mistletoe, upon a close inspection, was found bearing a profusion of small, greenish and altogether inconspicuous flowers, with precisely the fragrance of pond lilies; and so the pleasant riddle of the previous night was solved.

The fourth day's travel brought nothing new or specially interesting in the line of the botanical; but the larger size of the mezquit trees, and the more frequent occurrence of them would have indicated, even if the miles had not been counted, that we were nearing, gradually, the banks of the Colorado, the eastern boundary of the desert. And here let us notice more particularly this characteristic and most important of the native trees of the far Southwest, the common mezquit (*Prosopis juliflora* DC.). To give a general idea of the species, we will compare it with the honey locust (*Gleditschia triacanthus* L.) a tree well known almost everywhere east of the Mississippi, and not remotely allied to the mezquit. The two species, in several points, very strongly resemble each other. The leaves and flowers of both are much alike, and both have their branches armed with stout, forbidding thorns. But while the honey locust grows erect and displays a well shaped head, the massive trunks of the mezquit usually almost recline upon the ground for about two-thirds of their length; and there are commonly four or five of these half reclining trunks growing from one root; so that a good forest of mezquit, which would really, if cut down, yield a vast amount of wood, looks more like a straggling orchard of old and deformed apple trees than like what would be called a fine piece of timber. The fruit pods, borne in heavy clusters, are as long as those of the honey locust, but very narrow' hardly the fourth of an inch in width, thin and flat; and instead of the sweet reddish pulp of the locust pod, the mezquit has its seeds imbedded in an abundance of a hard, white substance, very sweet, and which the chemists tell us is grape sugar in a state of great purity. Horses, horned cattle and swine are very fond of these mezquit beans, as they are called, and fatten rapidly when fed on them. Moreover, the "mezquit meal," which Indians and Mexicans manufacture by drying and grinding these pods and their contents, is perhaps the most nutritious breadstuff in use among any people, barbarous or civilized. In these regions where no grass grows, and where the growing of the cereals is limited to the valleys of rivers that are few and far between, the importance of the mezquit, from an economic point of view can hardly be overestimated. The wood burns with an intensity of heat that is unfavorable to the nicest results in baking, and also destructive to iron; hence the few setlers on mezquit lands who brought stoves along, use any other wood rather than mezquit to burn in them, but the best of charcoal is made from it. They assure us that this species of timber possesses the singular property of seasoning without undergoing any perceptible shrinkage. Freighters and immigrants passing over these desert regions, where of course there are no such things as wagon shops for hundreds of miles together, being obliged to do their own wagon repairing, always replace the broken spoke or felly with one made from green mezquit, and the new piece does not shrink away and become loose and useless as it would if made of, for example, a stick of unseasoned oak.

Besides this common and most useful species there is another, called the screw mezquit (*Prosopis pubescens* Benth.), on account of its short pods being closely twisted into the shape of a screw. This is a smaller tree, of no importance except that its pods have the same nutritious properties as those of the larger and more common sort.

Having now become familiar with all the principal trees, bushes and herbs of the great, desolate wilderness, I was not sorry when I knew myself to be approaching the banks of the Colorado and the habitations of civilized men. During five days I had never met a fellow traveler of any complexion on the road save that gang of naked giants, the Yumas before referred to. It was therefore a new and rather pleasant species of incident that befell me when within thirty-five miles of my journey's end I met a pedestrian of my own color. It was a fair haired, handsome French boy of eighteen or twenty years, who came plodding along through the heated sands in his stocking feet, and carrying over his shoulder a pair of new boots. His brand new suit of army blue, together with the manifestly unquiet condition of his nerves, told all too plainly the tale of desertion from the U. S. Army. His first words when we met were to ask how far it was to water. I pitied him most sincerely, for I had to answer "at least ten miles;" at which discouraging news he, however, stamped the sand in such emphatic wrath, and gave vent to such a volume of French profanity, as quite satisfied me that he was good for the ten miles even without refreshment. He had taken French leave of Fort Yuma on the Colorado early in the course of the previous night, and was now at midday full thirty-five miles out upon the desert, on his way to San Diego. Not having dared to appear before the inmates of the one station he had passed, he was now sorely pressed by thirst and hunger, and also harassed by the fear of falling into the hands of possible pursuers. When we parted he begged me not to give any information concerning him to any military party I might chance to meet upon his track; and certainly for his youth's sake, and for the courage displayed in that bold adventure of a solitary flight across this hundred miles of desert, I did wish for him a clean escape, fugitive that he was.

Twenty-four hours later this other adventurer had accomplished his undertaking; the desert had been crossed, and he sauntered leisurely and content under the cottonwoods and tall willows that make up the forests of the lower Colorado valley. It was only the twenty-second day of February, but the cottonwood trees were in full leaf and gave delightful shade. The willows, though they had not yet divested themselves of more than half their last year's foliage, were in flower. The yellow catkins were actually crowding off the leaves which had kept their places and retained their freshness during the brief frostless winter.

This belt of riverside timber is occupied by the Yuma Indians; but from the roadside no dwellings of the aborigines were apparent. One saw, however, numerous pathways which had been cut through the dense thickets leading from the road to the villages, and the voices of Indian children at their sports came ringing out from the deep shady distance. On gaining the open river bank, I saw, near the ferry, four stalwart Yumas, in their usual picturesque costume of a red and yellow striped breech cloth, lying fast asleep on the upturned bottom of an abandoned flat boat. I disturbed not their slumbers. Two Mexicans near by interested me more; for they, observant of my approach, stood holding the oars of their rude skiff, eager to earn "dos reales" by transferring me to the opposite bank. I was not unwilling to avail myself of their services. Once on the Arizona side of the river, an hour's walk would bring me to the thriving little town of Yuma, and my five days on the desert had well prepared me to appreciate the comforts of a well kept village hotel and the society of the civilized.

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THE METHOD OF DISTINGUISHING SPECIES OF POPULUS AND JUGLANS BY THE YOUNG NAKED BRANCHES.[1]

BY PROF. W. J. BEAL.

IT is supposed to be the aim of the botanist when he describes a plant to name the peculiarities which are the most striking and constant, especially those which are easily seen with the unassisted eye. The writer has often been surprised that the peculiarities of the pith, bark, leaf scars and buds of our deciduous leaved trees and shrubs are not more frequently given in descriptions.

For five or six months of each year most of these plants are destitute of flowers, fruit or leaves. If it is easy or possible to distinguish species by the points above named, it certainly would often be very convenient. In 1876, Frederick Brendel, of Peoria, Illinois, said:[2] "We have no surer guide than the characters taken from the arrangement, form and construction of the buds, and in many cases from the leaf scars."

I will now proceed to point out some of the differences between the species of Populus and of Juglans, as seen when the young growth is destitute of foliage. I have studied four species of Populus and two of Juglans, all natives of Michigan.

Populus tremuloides.—In very slender branches one year old all of the pith is green; in larger branches a green layer surrounds the pith, which is of a whitish color much resembling the wood. With a short exposure to the air the pith becomes brown.

The bud scales are polished. The transverse diameter of the

[1] Read at the Boston meeting of the American Association for the Advancement of Science, Aug., 1880.

[2] Bulletin of the Illinois Museum of Natural History, No. 1, page 26.

leaf scar slightly exceeds the vertical diameter. Fig. 1, *a b c*, illustrates the buds and bud scars of *P. tremuloides*. The buds are not viscid. The one lettered *a* is a drawing of a portion of a

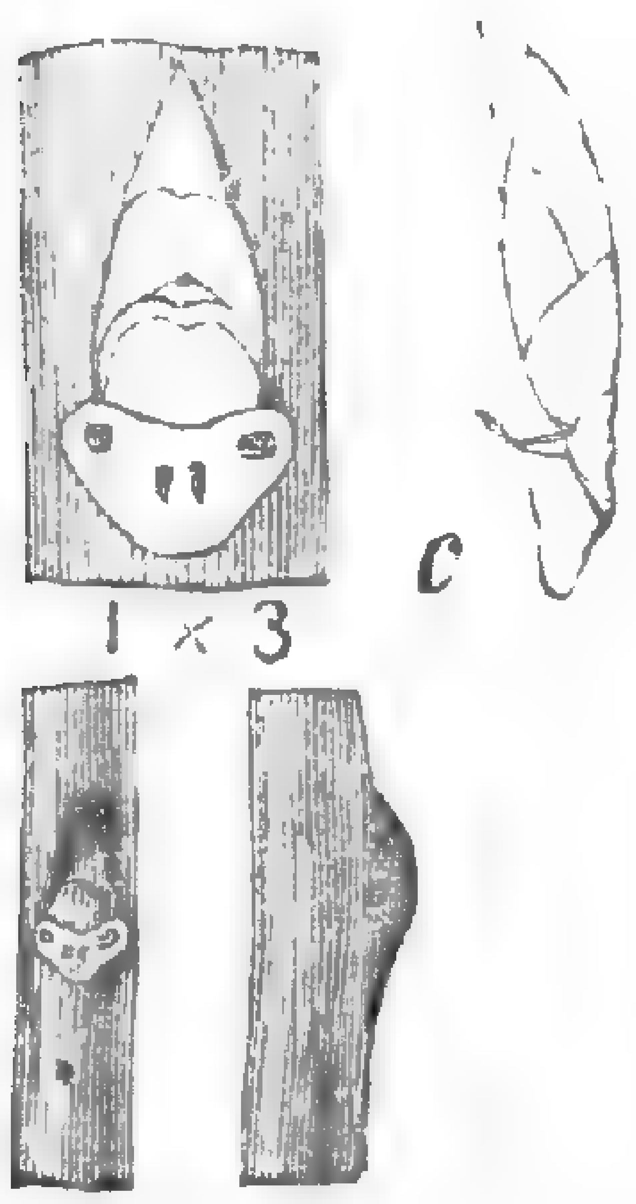

FIG. 1.

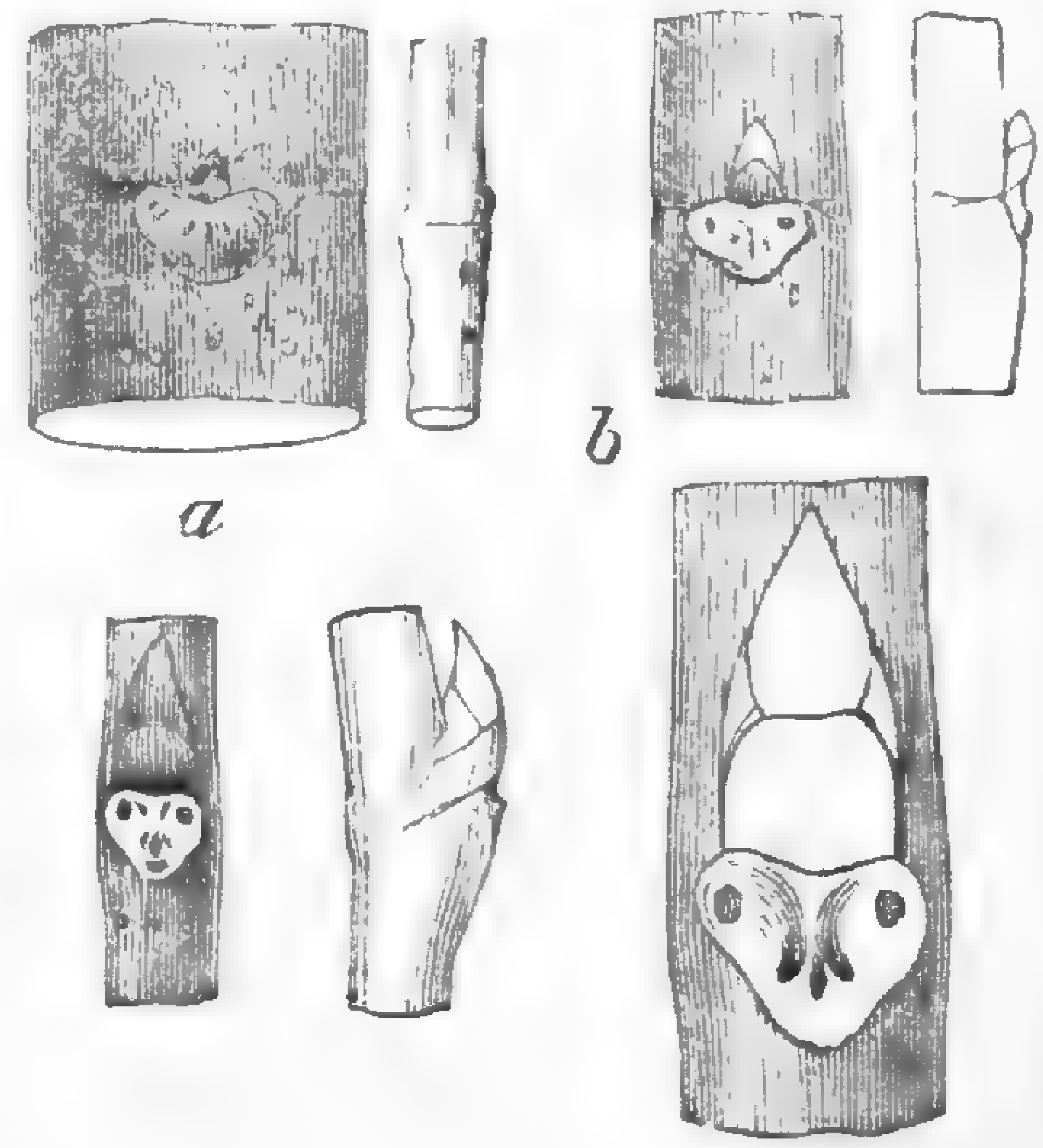

FIG. 2.

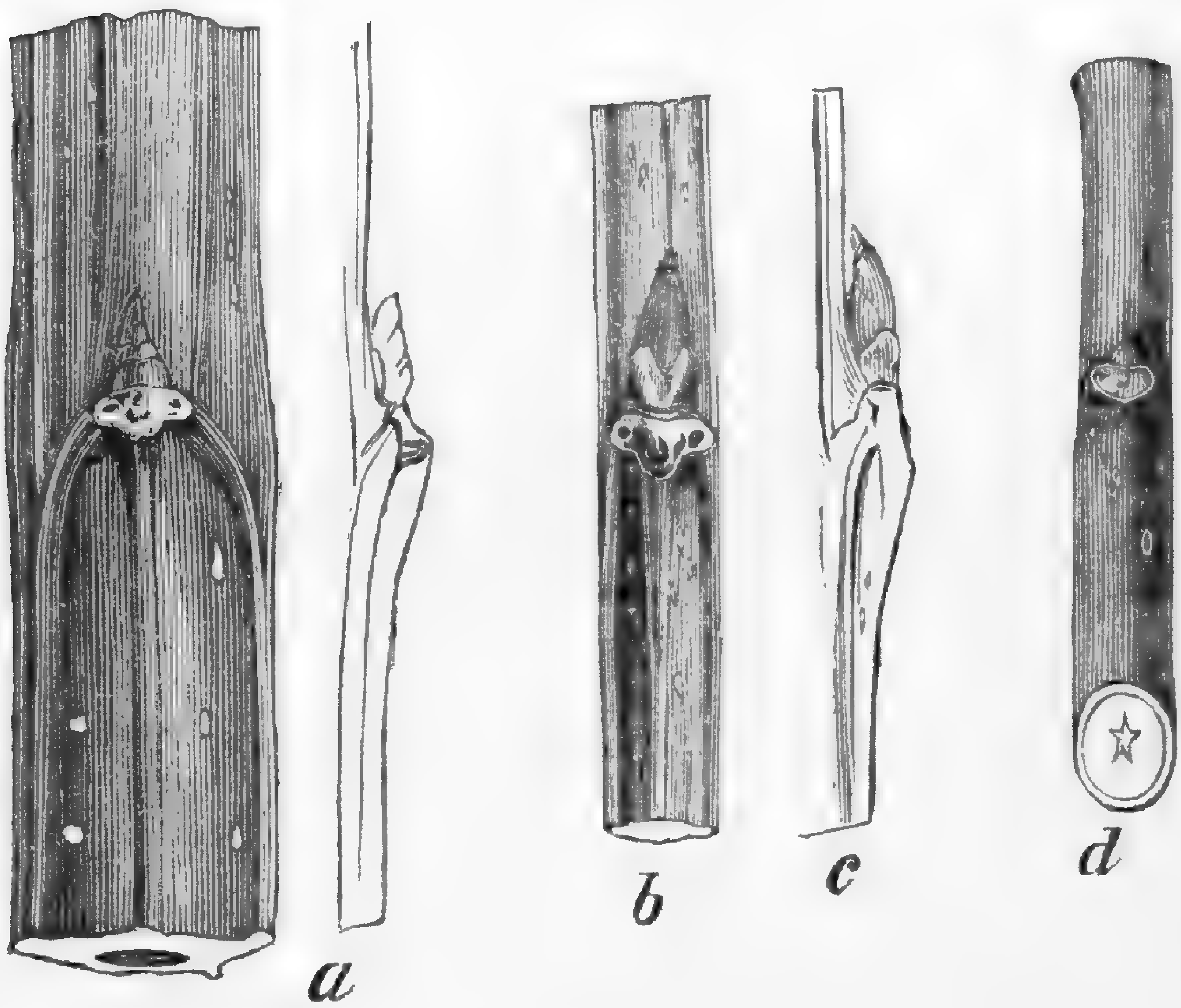

FIG. 3.

EXPLANATION OF THE FIGURES.

FIG. 1.—*Populus tremuloides*. *a*, scar and bud near base of branch, enlarged three diameters; *b*, natural size near the middle of a rapid growth; *c*, front and side view of same enlarged three diameters.

FIG. 2.—*Populus grandidentata*. *a*, enlarged front and side view of bud and scar near the base of a year's growth; *b*, the same farther up the stem; *c*, enlarged view near the middle of stem.

FIG. 3.—*Populus monilifera*. *a*, natural size figure near the middle of a large thrifty growth; *b c*, views of middle of slender growth; *d*, view near the base of stem.

stem not far from the base of the growth of last year; the others are taken from near the middle of the same growth. These illustrations and the succeeding ones are all drawn to the same scale, unless otherwise designated.

Populus grandidentata.—In thrifty twigs, one year old, the pith is yellowish white; the wood greenish white. The pith in twigs two or three years old is light brown. The buds are slightly pubescent under a lens and of a grayish-brown color, not viscid. Near the middle of a branch, the leaf scars are about as broad as long. Near the base the transverse diameter is the greater. The internodes of this species in slow or in rapid growth are much longer than those of *P. tremuloides.* They are often twice as long in stems which have made the same amount of growth. Fig. 2, *a b c*, illustrates the buds and leaf scars on young stems of *P. grandidentata.*

Populus monilifera.—The pith is light-brown and a cross section is usually pentagonal. In most slender young branches the pith is green, changing to brown on an exposure of a few minutes to the air. The shape of the leaf scars is about midway between that of *P. tremuloides* and *P. grandidentata.* Branches which have made slow growth and the base of thrifty branches are often without angles on the surface. Thrifty young branches have from five to eight prominent vertical ridges. One of these ridges extends below the center of a bud and one runs down from either side of the leaf scar. The branches are of a yellowish or greenish-brown color. There are a few round or oval white or brown spots on thrifty stems a year old. The buds are brown, viscid, not very glossy, and are destitute of pubescence, except a little on the margins of bud scales. The buds are larger but their shape is much the same as those of *P. tremuloides.* On thrifty branches there are often some buds mixed in with those larger which are short and not fully developed. For illustrations see Fig. 3, *a b c d.*

Populus balsamifera.—The young branches are brown and polished. The lower buds of the season are broad and small, and the scar below is broad. The lower buds and leaf scars of these four species of Populus are much alike in shape. The buds on the middle of the thrifty growth of *P. balsamifera* are quite long, often seven-eighths of an inch. They are curved and pointed, and become viscid. Fig. 4, *a b c d e*, illustrate buds and leaf scars of this species.

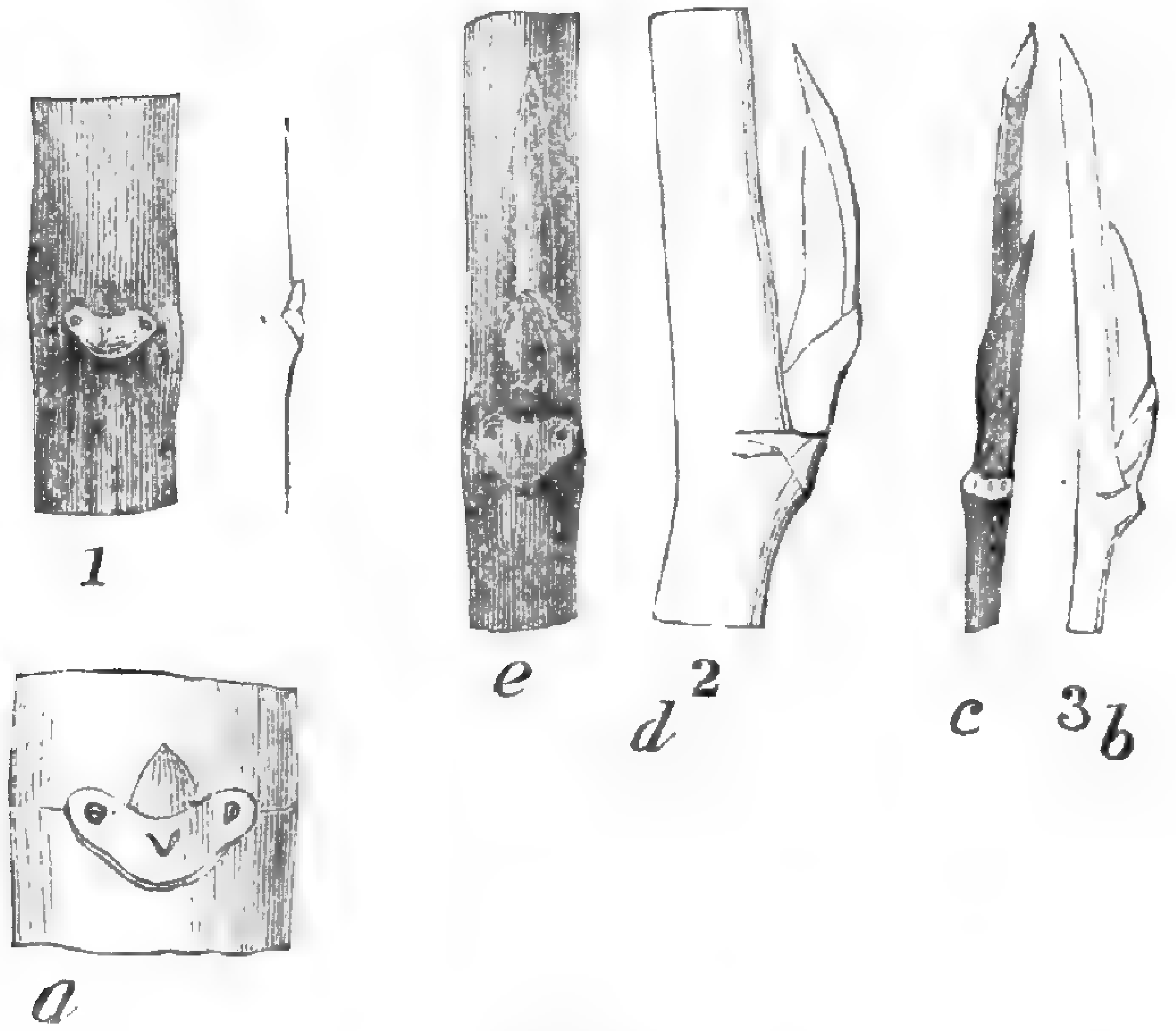

FIG. 4.

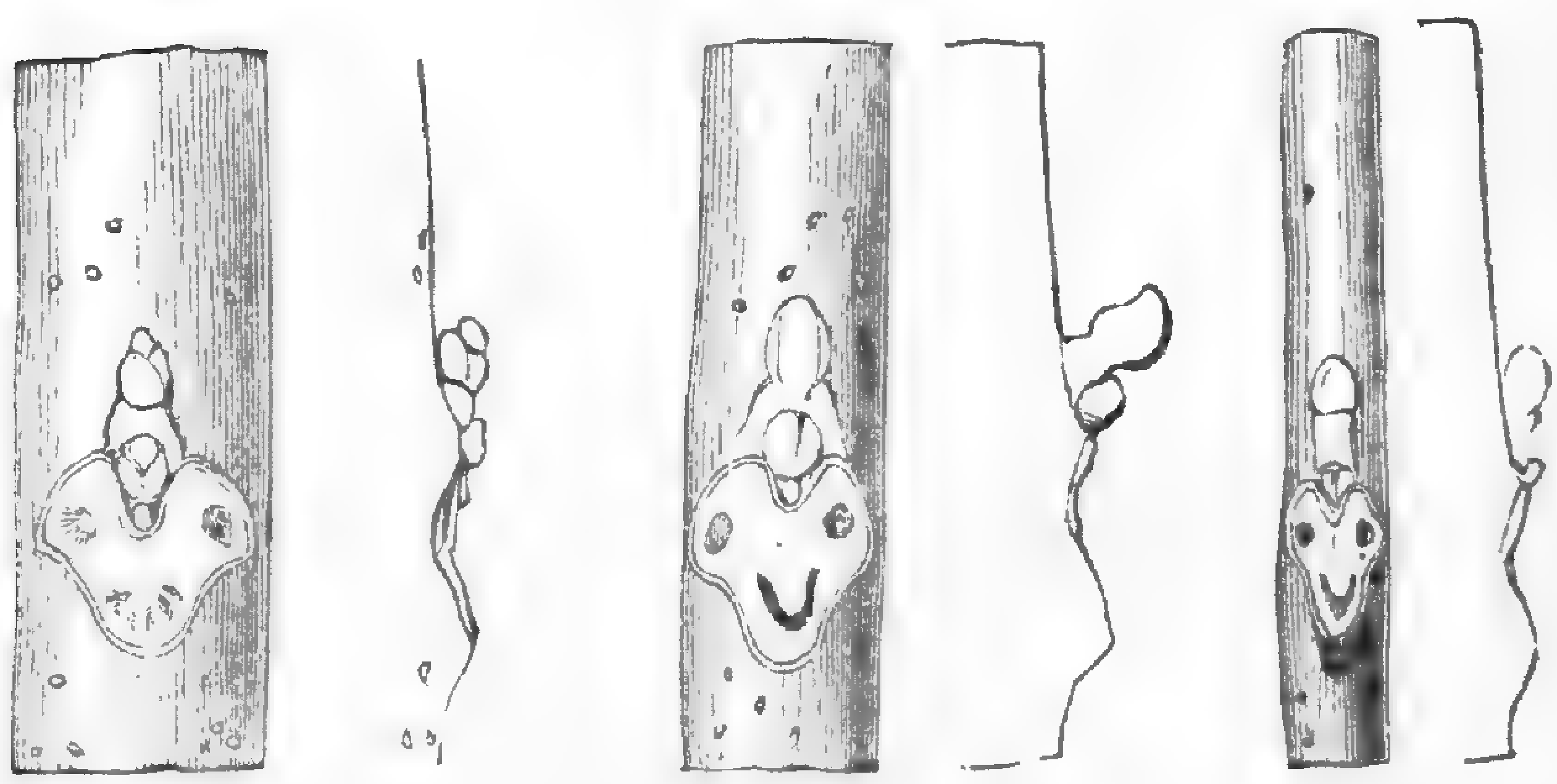

FIG. 5.

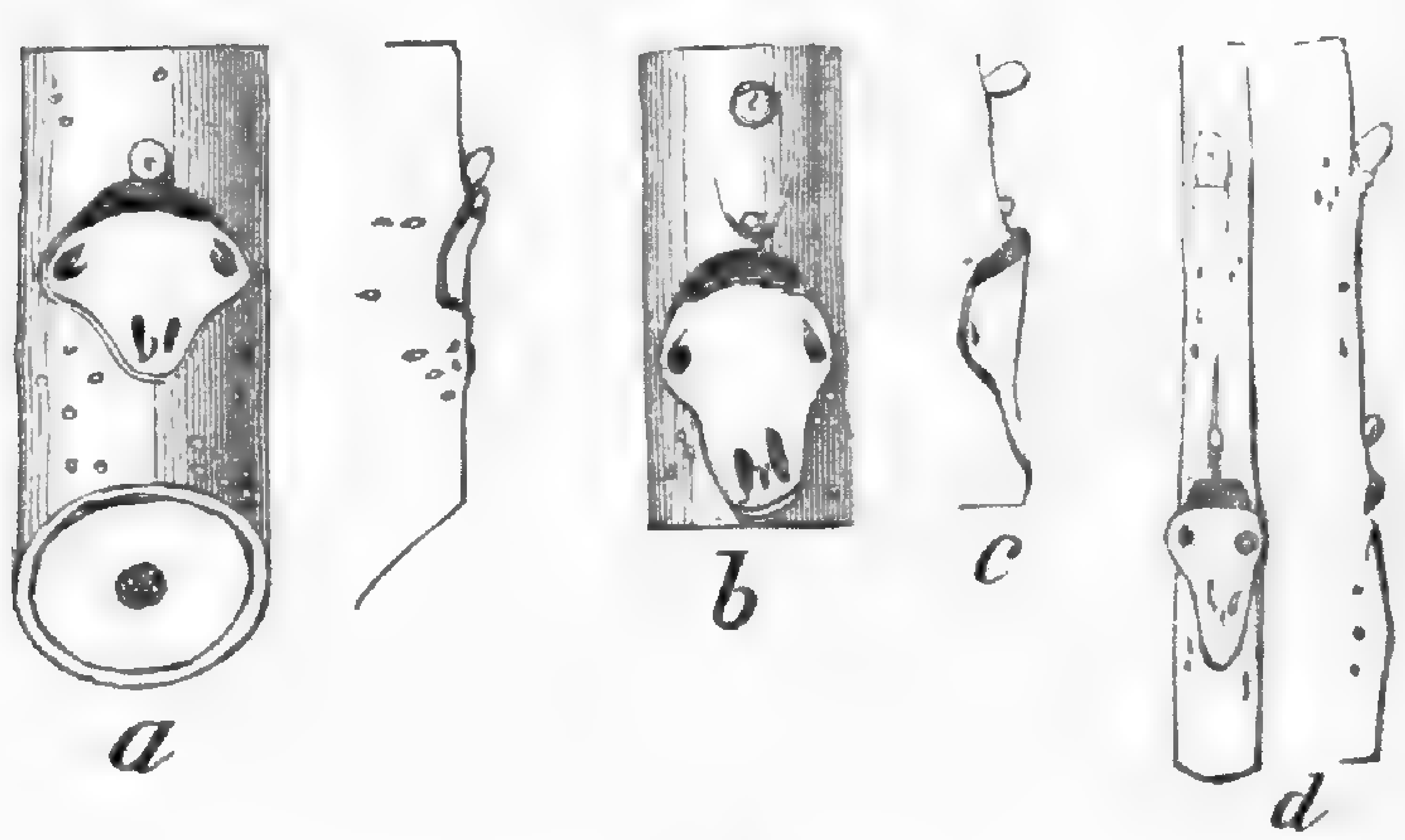

FIG. 6.

EXPLANATION OF THE FIGURES.

FIG. 4.—*Populus balsamifera.* *a*, enlarged view of stem near the lower end; *b c*, views of middle of a very slender stem; *d e*, views of middle of a large growth of a thrifty stem.

FIG. 5.—*Juglans nigra.* A front and side view of thrifty growth near the base; *b c*, a similar view from a thrifty branch near the middle; *d*, similar views of a slender stem near the middle or top.

FIG. 6.—*Juglans cinerea.* *a*, two views of a stem near the base; *b c*, similar views near the middle of a branch, *d*, similar views of slender stems.

Juglans nigra.—The pith of this species consists of thin plates running transversely, leaving open cavities between them. The pith is of a light-brown color. On a thrifty branch the bud scar is nearly heart-shaped with vertical and transverse diameters about equal. A very small bud can be seen in the sinus of the scar. Above this is a larger bud, most of which is also within the sinus of the leaf scar. Above these buds is a third one, still larger. The transverse diameter of the leaf scar is about equal in length to the distance between the leaf scar and the tip of the upper bud. A side view of the leaf scar shows quite a sharp depression in the middle. On slender branches the bud scars are laterally compressed or appear longer than on stout branches. Fig. 5, *a b c d*, illustrate this species.

Juglans cinerea.—The pith is separated in plates. It is of a dark brown color and in a narrower cavity than that of *J. nigra.* The leaf scar on a thrifty growth is not unlike the shape of a sheep's face. The scars left by the woody bundles of the leaf are shown in the drawings of all the species above mentioned. Towards the lower part of a branch, one bud only appears above the leaf scar; farther up on thrifty branches two buds may be seen. The scar is without any sinus or depression at the top. In this species, on the middle of rapid growth, the upper bud is from one-fourth to two-thirds of an inch or even more above the top of the leaf scar. Along the top of the leaf scar is a transverse or curved ridge or crest resembling velvet or plush. This crest is not present in *J. nigra*, but is rarely if ever absent in *J. cinerea.* The bark on a thrifty branch of *J. nigra* when one year old is about a third thicker than that on branches of *J. cinerea* of the same age and size. After the first year, and sometimes sooner, the outer bark of *J. nigra* cracks and rolls up in scrolls, while the outer bark of *J. cinerea* shows nothing of the kind. Fig. 6, *a b c d*, illustrates this species.

The young trees of these two species of Juglans are not easily distinguished by the leaves. In the axil of the leaf of *J. cinerea*, even when quite young, can be seen the velvet ridge. The odors of crushed leaves of the two species are different.

Some observations lead me to believe that many other trees and shrubs can be equally well distinguished by the young naked branches, while in some cases it will be difficult to find good specific characteristics. The drawings for this paper were made by W. Holdsworth.

AN ADDRESS TO THE FOSSIL BONES IN A PRIVATE MUSEUM.

BY JAMES S. LIPPINCOTT.

"And you have walked about—how strange a story!"
In days gone by, a million years or so,
When giant saurians were in all their glory
In the dim twilight of the long ago!
When Hadrosaurus reared his height stupendous,
And Aquilunguine Lælaps leaped tremendous!

Could ye but speak, what stories you could tell us!
How on the oozy flats you floundered free;
Elasmosaur and all his scaly fellows
That fished and paddled the Cretaceous sea,
And Mosasaurus, how he showed his tushes
Ages ere Moses boated 'mong the rushes!

That "there were giants in those days" is certain,
Not such as those by Scripture story told,
Nor known to us till science raised the curtain,
Their length and breadth and stature to unfold;
Monsters of flesh and bone and horny mail,
And jaws and claws and ponderous length of tail.

Oft have we queried, wherefore had ye birth,
And wherefore sent into a world like this
Ages ere perfect man appeared on earth?
As told in chapter first of Genesis,
Of which our Savans have not yet been able
To show how much is fact, how much is fable!

The "dark idolator of chance" may learn
A lesson pregnant from your gray remains,
See proof of plans, deep-laid, he may not spurn,
By Power Creative, through all time the same;
See glimpses of the slow evolving plan
Developing the monad up to man.

Then hail your advent to the light of day!
A revelation of old time to this,
Along the darkened past a brilliant ray
Lighting an else unfathomable abyss!
And hail to him whose skill your import can make plain,
Can reconstruct the past and make it live again!

REPLY TO J. S. L.

My dearest cousin, several times removed,
  Since you have called me from the vasty deep
To witness how our race has been improved,
  Pray hear my answer ere you go to sleep.

And first I hold that it is not polite,
  To call relations by such horrid names
As Hadro-mosa-sauri, which excite
  Suspicion of the justness of your claims.

You seem in fact to have ransacked your brains
  To find some endless word to suit my bones,
I'll take some little pity on your pains,
  And tell you plainly that "my name is Jones!"

And I was born so very long before
  Your puny race appeared upon the earth,
That human fancy ne'er may hope to soar
  Back to the bygone age which saw my birth.

That to each other we have not been known,
  Is owing to your most egregious fault;
For this confounded piece of marly stone,
  Has served for ages for my burial vault.

Your ancient Scripture cannot be so old
  Or nigh as perfect as this mass of rocks,
In which the patient seeker may behold
  Foundations of a faith most orthodox.

It is not treating me as I deserve
  To end the monad series with a man,
Presumption founded on some extra nerve
  Which you possess, does not destroy the plan.

Be warned in time lest overbearing pride
  May be the chief occasion of your fall,
Let future beings 'twixt us both decide,
  Which was the master and which was the thrall.

Farewell! my voice is now forever hushed,
  No more to be evoked by prose or rhyme;
The hue of health which once my temples flushed
  Has changed to that of carbonate of lime!
  Farewell! at least until the end of time.

EDITORS' TABLE.

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

—— We have received the report of the Secretary of the Interior for the year ending June 30, 1880. We find contained in it a recommendation to the President of the United States in favor of the Geological Survey as conducted under its present director, Clarence King. The accompanying summary of the plan of organization of the survey, impresses us favorably, and science should reap a rich harvest were its effectiveness assured by a strong *personnel* and a proper direction of their work. The reports of progress which it is proposed to publish, will, we are informed, consist of the following twelve volumes: "Geology and Mining Industry of Leadville, Col.," by S. F. Emmons; "Geology of the Eureka mining district in Nevada," by Arnold Hague, geologist-in-charge; "The Copper Rocks of Lake Superior, and their continuation through Minnesota," by Prof. Rowland D. Irving; "The Comstock Mines," by Eliot Lord; "The Comstock Lode," by George T. Becker, geologist-in-charge; "The mechanical appliances used in mining and milling on the Comstock Lode," by W. R. Eckard, chief engineer; "The Coal of the United States," by Raphael Pumpelly, geologist-in-charge; "The Iron in the United States," by Raphael Pumpelly; "The precious metals," by Clarence King, director; "Lesser metals and general mineral resources," by Raphael Pumpelly; "The Uinkaret Plateau," by Capt. C. E. Dutton, geologist-in-charge; "Lake Bonneville," by G. K. Gilbert, geologist-in-charge; "The Dinocerata, a monograph on an extinct order of ungulates," by Prof. O. C. Marsh, palæontologist.

We are naturally impressed, on reading this statement, by the great predominance of the economic side of geology over the purely scientific, a tendency already visible in Mr. King's Report on the Geology of the Fortieth Parallel. In this work one volume was devoted to mining machinery, a subject which we claim to be foreign to the scope of a scientific geological survey. This tendency is developed to the full in the programme set before us, so that it really looks more like the prospectus of a mining engineer than a plan for the advancement of geological science. That the country does not require this kind of work to be done by the Government, is self evident, since the employment of geological and mining experts for the services apparently contemplated by the reports in question, is matter of every day occurrence. The United States geologist, in proposing such a scheme, has entered upon a sea of difficulties, of which he must but too soon become aware. We maintain that retention as a mining expert should be regarded as a disqualification for the position of United States geologist. The tremendous pressure of the mining interests of the country upon the occupant of that important position must be too great for any but a man exclusively devoted to purely scientific interests, to properly resist. The men for the place are devotees of science like Hayden, or engineer officers like Wheeler; men who do not know enough of the relations of fees to "expert reports," or of stock jobbing operations, ever to risk the sacrifice of their professional independence by alliance with any interest of the country whatsoever.

Mr. King's scheme represents a new departure in government scientific work, and one which we regret. It may indeed be said, that the titles of his proposed volumes are purely *ad captandum*, but from the previous history of this gentleman, we cannot accept this as a valid explanation. Hayden and Wheeler never thought it necessary in the past to suppress the claims of pure science, and they cannot complain that Congress was not liberal in its appropriations. Congressmen are indeed aware that the only function of government in the matter is to develop knowledge for the sake of all interests, and not for the sake of any particular interest. It is not necessary for the scientific men of the country to change their attitude after the successes of the past decade. But Mr. King is essentially a mining geologist, which may partly explain the various serious scientific blunders to be found in the palæontological and mineralogical portions of his report on the geology of the fortieth parallel. That the new United States Geological Survey would run into this channel, is no more than we anticipated at the time of the abolition of the old surveys, and formed one of the grounds of our opposition to the change at that time.

The proposition to extend the United States Survey over the old States is one that depends for its merit on the manner in which it is carried into effect. To relieve the several States of the responsibility of making geological surveys of their own territory would be a positive injury to the scientific interests of the country. The aggregate appropriations made by the States for this purpose must, in the end, exceed the amount which the National Government could devote to the same object. The State Legislatures ought not for a moment to be allowed to suppose that the General Government will relieve them of the necessity of looking after their own interests. But a United States Survey should undoubtedly have general supervisory powers over the entire country. It should collate the results of the State surveys for its reports, and use their maps in making up its own. Its relation to the States should be about that of the Bureau of Education to the State school systems.

—— The adverse influence of city life on the development of young naturalists, and the great lack of active scientific societies in our larger cities, with the exception of Boston, Philadelphia, New York, Washington, Salem, Buffalo, Cincinnati, St. Louis and Davenport, is perhaps a subject worth considering.

The cultivators of natural history imbibe their early love for nature during their out-of door, early life in the country. Nearly all our leading naturalists were country-bred boys. So flourishing an organization as the Society of Natural History at Boston, counts, we believe, only two active leading members born in that city; the membership is made up largely of those brought up in more immediate contact with nature. The city naturalists are reinforced from the country. The scientific societies in the cities above mentioned are maintained largely by physicians or college professors, originally country-bred. If city life were more conducive to the growth of natural history studies, why do not such cities as Chicago, Baltimore, Louisville, New Orleans, Charleston, Savannah, Pittsburg, Providence, Worcester, Springfield, Rochester, Trenton, Indianapolis, and Portland—we select the names much at random—maintain flourishing societies? The subscription list of this magazine has always consisted mostly of those living in the Western and Middle States; it is in the smaller communities, many of them college towns or villages, that naturalists develop, though we wish we could say that they thrive there.

In the country native zeal and enthusiasm, the powers of close and prolonged observation—communing with nature—arise spontaneously on the farm and at the country-seat; transplanted into the city, country-bred naturalists can organize and build up museums and libraries and publish the results of their studies, but the original material is drawn from those who live in villages or the suburbs of the larger cities. Natural history is now extensively taught in the public schools of our cities, and much effort is thus expended to manufacture naturalists, or to induce a respect for scientific studies, but the efforts are too recent to bear immediate fruit. The exodus for two or three summer months into the country of families, now so marked a feature of our larger cities, will, we hope, in the long run bring the children of the present generation into immediate contact with nature and result in a harvest of naturalists, endowed with a simple love of nature and zeal for scientific pursuits, and the love of truth and knowledge for its own sake, which will instill a wholesome spirit into our national life.

—— We hope to be able soon to furnish some statistics as to the organization of scientific bodies in the United States. We look forward to the time when each State will have its Academy of Sciences, and it is only a question of enlightened self-interest on the part of existing bodies, as to which of them becomes the Academy of Sciences of the State where it is situated. Of course such an institution is yet impossible in many of the States, where science is only represented by amateurs, or not at all; but in a number of them, real academies could be organized to-day. The present policy of electing gentlemen to full privileges in scientific bodies for $5 or $10 a year, must soon terminate the existence of such bodies as scientific, from natural causes; the property being thus slowly, but surely, alienated from the uses for which it was originally designed. The only American societies which are so constituted as to be self-protective in this respect, so far as we are at present informed, are the National Academy of Sciences, the Boston Society of Natural History, and the New York Academy of Sciences. The men devoted to original research in Philadelphia, Cincinnati, Chicago and St. Louis, are becoming numerous, and may be expected to follow early in the footsteps of their more enterprising predecessors.

—— The scientifico-literary critic of our esteemed contemporary the New York *Times*, has recently given his readers his views as to the AMERICAN NATURALIST, some of which are wise and some otherwise. There is a flavor about some of his remarks which reminds us of the funeral of a late scientific journal in another city, at which our critic may have been a mourner. He gives us a favorable opportunity of making a statement regarding the policy of the NATURALIST. He observes, "what it needs is a catholic management which would print articles even if the theories presented could not receive the entire assent of the editors," etc. As the NATURALIST has eight editors, more than any other scientific journal in the world, of whom five are acknowledged experts in original scientific research, an article must be very eccentric in its politics not to meet the approval of some of them. As a matter of fact, the NATURALIST will always print articles within its scope, which are accurate as to matter of fact, and intelligent in treatment, no matter what the theories of the authors may be.

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RECENT LITERATURE.

THE NATURALISTS' DIRECTORY FOR 1880.[1]—We have before us the last edition of this once useful work. It is difficult to imagine what possible object the editor had in view in the arrangement of the contents. We cannot see how it can be of the least use to any one, as the names are arranged by States, and there is no alphabetical or subject index. A very considerable portion of the volume is occupied with advertisements, many of them

[1] *The Naturalists' Directory for 1880.* Edited by S. E. CASSINO. Boston, S. E. Cassino, Publisher.

totally foreign to subjects connected with science. The time once was when a Naturalists' Directory was a great desideratum, and the first edition of Mr. Cassino's work was valuable, but since that time there has been a steady deterioration, and it seems that at present the work has degenerated into a means of collecting an annual assessment on all the naturalists of the country for the personal benefit of Mr. S. E. Cassino.—*J. S. K.*

SHELL HEAPS IN JAPAN.—No doubt many of the readers of the AMERICAN NATURALIST observed in the issue for last September, a criticism by Prof. Morse on two recent publications on Japanese archæology. One of these publications, which is by myself, is entitled "Notes on Stone Implements from Otaru and Hakodate, with a few general remarks on the prehistoric remains of Japan." It was published in the transactions of the Asiatic Society of Japan, in February, 1880. The other publication to which Prof. Morse desires to call attention, is a handsome volume on "Japanese Archæology," by Henry Von Siebold, a gentlemen who, whilst residing in this country for over fifteen years, has for a considerable portion of this time made archæology a specialty, and accumulated materials and information, as compared with which the works of all others are but insignificant. The only other recent publication on Japanese archæology is the memoir on the "Shell Heaps of Omori," by Prof. Morse himself, a volume full of most valuable material. The conclusions which Prof. Morse deduces from his materials are probably not those which he would have arrived at had his visit to Japan been less flighty, or had he more thoroughly acquainted himself with the literature (European and Japanese) of the subjects about which he wrote. One conclusion to which Prof. Morse has come, is, that the shell heaps he describes are not those of the early Aino inhabitants of this country, but probably pre-Aino, and those who venture to put forward opinions which are contrary to his own, he evidently desires to hew and hack at until they are quite exterminated. As nearly all the workers at the archæological materials which are so profusely spread throughout Japan, have opinions which are opposed to those of Prof. Morse, the task before him is extensive. In the shell heaps of Omori, Prof. Morse has found a number of human bones, and amongst these several fragments of platycnemic tibiæ. These bones are exhibited in the museum of the Tokio University. I may remark that although I and *many* others have made numerous visits to the Omori heap and collected many basket loads of bones, we were not fortunate enough to find anything which was human. Speaking of the bones found by Prof. Morse, I remark in my paper referred to, "If such tibiæ are characteristic of the Ainos, and I am assured that such is the case, we have here another indication pointing in the same direction," namely, that the shell heaps in which these tibiæ are found, are probably of Aino origin. This quotation is the only remark which I made in my paper upon this subject. In a challenge I am asked by Prof. Morse on what authority I have stated that the Ainos have platycnemic tibiæ, and further Prof. Morse would have me regarded as the author of such a statement.

Assuming that what I have said places me in the responsible position which Prof. Morse, by wrongly interpreting my words, is evidently desirous that I should occupy, I will say, that if Prof. Morse had acquainted himself with the literature relating to the Ainos, he would most certainly have avoided remarks upon this subject, and thus have saved himself from a predicament which, to say the least, looks extremely awkward.

As an answer to Prof. Morse, let him refer to the well-known *Russische Revue* (10 Heft, VI Yahrgang), edited by Carl Röttger. He will there find a quantity of valuable information relating to the Ainos, and amongst the rest something bearing on the point now under discussion, of which the following is a translation: "With reference to the anatomy (of the Ainos) it is remarkable that the humerus as well as the tibia has a very striking form; they are marked by an *extraordinary flattening (auserordentliche abplatung) such as has, up to the present, never been noticed of those bones in any people at present in existence.* On the other hand this peculiarity of form has been observed in the bones of extinct people found in caves." (The italics are mine.) Further remarks upon Prof. Morse's attack are, I think, unnecessary. If those who are interested in this subject will refer to my original article, it will be seen that much of what Prof. Morse has objected to, is due either to his misrepresentation of my language, or to his want of information on some of the subjects he has written upon; and I can assure your readers that the whole of his remarks may be answered as easily as the subject of platycnemic tibia has been answered.—*John Milne, Imperial College of Engineering, Tokio, Japan, Oct. 19, 1880.*

THE BOTANY OF CALIFORNIA, VOL. II, BY SERENO WATSON.—This beautiful volume is fully equal in beauty of finish, and botanical interest to its predecessor, which appeared in 1876.

The same externally, it internally presents the large clear type, and broad margins which distinguished the earlier volume. This volume begins with the Apetalæ, which includes twenty-five orders. Of these the Polygonaceæ and Chenopodiaceæ are particularly interesting on account of the numerous species of Eriogonum (52) and Chorizanthe (25) of the former, and of Atriplex (21) of the latter. The nineteen species of willows, are arranged and described by M. S. Bebb. Dr. Engelmann contributes the article on the oaks, of which there are fourteen species.

The Gymnosperms are placed, as is usual in English and American works, before the Monocotyledons. The Gnetaceæ are represented in California by two species of Ephedra, viz: *E. nevadensis* (a shrub two feet high) and *E. californica.* The Taxaceæ are separated from the Coniferæ as a distinct order, including Torreya, with one species, *T. californica*, and Taxus, represented by *T. brevifolia*. The Coniferæ, proper, include eleven genera and thirty-four species. Of the latter, at least, sixteen exceed one hundred feet in height, and no less than eleven of these reach or exceed the height of two hundred feet. The Abietineæ are described by Dr. Engelmann, and the arrangement is consequently the most recent. Instead of the old genus Abies, as we all learned it in Gray's Manual, we have Abies, Pseudotsuga, Tsuga, and Picea. Under Pinus there are fourteen species.

In the Monocotyledons, the Orchidaceæ are not numerous. This is, however, not the case with the Liliaceæ, represented by thirty-one genera. Many of the genera are rich in species, *e. g.*, Allium with twenty-three; Brodiæa with fourteen; Lilium with eight; Fritillaria, eight; Calochortus, twenty-one. Three palms are described as occurring in the southern part of the State, viz: *Washingtonia filifera*, *Erythea edulis* and *E. armata*. The sedges and grasses, the latter by Dr. Thurber, occupy more than one hundred pages of the volume. Nearly one hundred more pages are filled with descriptions of the vascular Acrogens (by Prof. Eaton), and the cellular Acrogens (Musci and Sphagnaceæ only). Fifty pages of "additions and corrections," mostly to Vol. I, an excellent index, a glossary, and a "List of persons who have made botanical collections in California," by Prof. Brewer, complete this volume. The authors (Brewer, Watson and Gray, for Vol. I, and Watson, for Vol. II) are to be congratulated upon the successful completion of this great work, and the liberal-handed business men of the Golden State are to be commended for their public spirit in furnishing the means for its publication after the Legislature had refused to do so. No other State is now provided with so excellent a work upon its native plants.—*C. E. B.*

BALBIANI'S LECTURES ON THE GENERATION OF VERTEBRATES.[1]—This work corresponds in some degree to that of Kölliker on the development of man and the higher animals, but is confined rather to the earliest stages of development, and particularly to the mode of formation of the egg and the male reproductive elements, subjects now occupying very closely the attention of observers in the different countries of Europe, while unfortunately our own land does not contain in its population of 50,000,000, so far as we are aware, a single person who is studying the points regarding early vertebrate development in an original way. Should there be any one desirous of examining into the subject, he would find the volume before us, although a little *passé* in some points recently worked out by E. Van Beneden, McLeod, Balfour, and probably several biologists in Germany,

[1] *Leçons sur la Génération des Vertébrés.* Par G. BALBIANI. Recueillies par le DR. F. HENNEGUY, Revues par le Professeur. Avec 150 figures intercalées dans le texte et 6 planches en chromo-lithographie hors texte. Paris, O. Doin, 1879.

still as useful and certainly as readable an introduction as he could desire. Balbiani has contributed additions to our knowledge of reproduction in the Arthropods and in the Vertebrates, and considerable new matter, illustrated with six chromo-lithograph plates, is given in the present volume.

ZITTEL'S HAND-BOOK OF PALÆONTOLOGY.—We have previously noticed this valuable hand-book, which is being issued in parts, the present one being the fourth of Vol. I. This completes the first division of the present volume, which treats of fossil Protozoa, Cœlenterata, Echinodermata and Molluscoidea. The present part finishes the subject of fossil worms, but is mainly devoted to the Molluscoidea, namely the Bryozoa and Brachiopoda, which are placed under the Mollusca. It will thus be seen, that the classification so far from being modern, borders upon the paleozoic. Still the matter under each class heading is detailed, accurate; the fossils are interpreted by reference to the living forms, of which a concise description is given, and, as we have before said, this work of Zittel's, is on the whole, superior to any that the student can obtain.

MCALPINE'S BIOLOGICAL ATLAS.[1]—The title sufficiently describes this atlas, the plan of which is pretty good, though often the figures are clumsy, and more or less misleading. For example, the figures of the anatomy of the lobster are coarse, rough, and convey little idea of the parts as they exist in nature; they look as though they were copied from rough colored-chalk diagrams sketched off-hand on the blackboard. The "zoëa of the lobster" is a rough figure of some decapod zoëa, but not the young freshly hatched lobster, which, as the authors should have known, has a much more advanced form than here represented. The drawings of the nervous system and eye of the same animal are abominable. Indeed, we could scarcely recommend the book for use in our schools and colleges. Something much better could have been prepared for the same money.

EATON'S SYSTEMATIC FERN LIST.—Prof. Eaton, of Yale College, has recently issued a "Systematic Fern List," which will prove useful to our botanists, who wish to know what proportion of our native ferns they have in their collections. The list includes all the known ferns of the United States, and gives the geographical range of every species, and is intended "to serve as a check-list, and at the same time to show the classification of the genera." Of the one hundred and fifty-one species enumerated, one hundred and forty are true ferns (order Filices), the remaining eleven be-

[1] *Biological Atlas.* A guide to the practical study of plants and animals, adapted to the requirements of the London University, Sciences and Arts Department, and for use in schools and colleges, with accompanying text, containing arrangement and explanation, equivalent terms, glossary and classification. 423 colored figures and diagrams. By D. and A. N. MCALPINE. Edinburgh and London, W. and A. K. Johnston, 1880. 4to, pp. 49.

longing to the order Ophioglossaceæ. Of the true ferns, one hundred and twenty-nine species fall under the sub-order Polypodiaceæ, one under Ceratopterideæ, two under Hymenophyllaceæ, four under Schizæaceæ, and three under Osmundaceæ. The pamphlet, which contains twelve pages, and bears date of September, 1880, may be obtained for ten cents by addressing the author.—*C. E. B.*

The Zoological Record for 1878.[1]—The fifteenth volume of this series is a little more bulky than the fourteenth, an evidence that the cultivators of the science of zoölogy are neither diminishing, nor the number of notices, articles and works contributed by them to journals and transactions. The editor and his assistants are the same as in the preceding volume, and we may feel sure that the omissions and errors inevitable to such work are comparatively few. It is a pity that so large a proportion, indeed almost the entire volume, is taken up with references to descriptions of new genera and species; these seem unfortunately to be as numerous as ever, and to draw away the attention of zoölogists, from the more pressing and legitimate objects of study.

The space devoted to biological and anatomical zoölogy should, it seems to us, be much greater than at present, and be made fully as prominent a topic as purely descriptive work; for this reason the parts on Cœlenterata and Echinodermata, Mollusca and Crustacea, with their analyses of discoveries made in the anatomy and physiology of these animals, is treated with more care and judgment than some other chapters. It seems to us that abstracts of articles in such journals as Siebold and Kölliker's Zeitschrift für wissenschaftliche Zoölogie, Troschel's Archiv für Naturgeschichte, and the similar French journals of Milne-Edwards and Lacaze Duthiers, as well as the *Quarterly Journal of Microscopical Science*, should be fuller, as these periodicals really contain the best material, *i. e.*, that which contributes most to the advancement of the science, and is or should be most eagerly read by students. As the new species get worked up, we may hope that more room will be found for such abstracts, as these are especially desirable for American students, who are exposed to the temptation of forsaking the true objects of zoölogical study, and betaking themselves to the mechanical, and not particularly intellectual work of describing new species and genera, and preparing local faunal lists without reference to future monographical work.

We may add what we have said in notices of previous volumes of this series, that no American student of systematic zoölogy can afford to be without the *Record*, particularly those living away from large libraries.

Jourdan's Zoantharian Corals of the Gulf of Marseilles. This important and well illustrated memoir, which appears in

[1] *The Zoölogical Record for 1878;* being volume fifteenth of the Record of Zoölogical Literature. Edited by E. C. Rye, F. L. S., etc. London, 1880. 8vo.

the Annales des Sciences Naturelles for 1880, bears particularly on the histology and embryology of the sea-anemonies and the coral Balanophyllia, and should be studied in connection with the brothers Hertwig's nearly contemporaneous work on the histology of the Actiniæ, now brought to a close in the Jena Zeitschrift.

Bastian's The Brain as an Organ of Mind.[1]—One of the author's objects in the preparation of this book was to show that not the brain alone, but the entire nervous system, is the organ of the creature's "mind," and this is shown by reference to the lower animals as well as the vertebrates. He also attacks Ferrier's conclusions as to the localization of the different intellectual powers in the human brain, believing that our knowledge is too imperfect to decide that. But while these are salient points which give tone to the book, the author has presented us with a most useful work upon the nervous systems of animals in general and the correspondence between the structure of the brain of the different classes of vertebrates and their mental powers, which is both novel and useful.

After treating of the nervous system of mollusks, worms and arthropods (crustacea and insects), the author reviews the data derived from a study of the nervous system of invertebrates, and claims that in insects the sense of smell is "marvelously keen," while that of hearing is "developed to a very slight extent." Here we may say that Dr. Bastian has not apparently availed himself of the latest studies on the internal structure of the brain of crustacea and insects by Dietl, Flögel and Krieger, and his own countryman, Mr. E. T. Newton; nor do we think he treats with sufficient detail or comprehensiveness the intellectual powers of insects. He is evidently more at home in the comparative structure of the brain of vertebrates, and here his conclusions and general views appear to us to be well grounded and sound.

As regards the vertebrates, beginning with an account of the brain of fishes and of Amphibia, he goes on to that of the reptiles and birds, and with these as a standard of comparison, pauses to consider the scope of mind in general, of reflex action and unconscious cognition, sensation, ideation and perception, and then discusses consciousness in the lower animals, the nature and origin of instinct, and of nascent reason, emotion, imagination and volition. These subjects will be interesting to those biologists who may be engaged in studying the habits and psychology of animals.

Dr. Bastian regards the whole nervous system as the "organ" of mind, the brain being merely its principal component part. According to his view, instead of supposing that mind and consciousness (in its ordinary acceptation) are co-extensive, mind should include all unconscious nerve actions as well as those

[1] The Brain as an Organ of Mind. By H. Charlton Bastian. With 184 illustrations. New York, 1880. D. Appleton & Co. 12mo,, pp. 708.

which are attended by consciousness. These views differ in one or other respect, he claims, from those of Spencer, Lewes and Bain, and still more widely on the other hand from the generality of metaphysicians who habitually regard mind as an entity, and speak of the "mind" using the brain as its instrument.

While the Medusa and organisms only a little above them, such as mollusks and worms, act unconsciously, the intellectual processes being but a few degrees more complex than those which may take place in a sun-dew or other sensitive plant, the author brings forward reasons for the belief that as the nervous system increases in complexity from the lowest animals to the fishes, reptiles and birds, so the mental and motor phenomena of which such organisms are capable, show a similar tendency to increase in complexity. Consciousness first seems to appear, according to the author, in insects, Cephalopods, fishes, reptiles and birds. "These organisms are so high in the scale of organization as to leave no room for doubt that some of their nerve actions are attended by conscious states, but it is impossible for us definitely to decide which are and which are not so endowed."

He ascribes little reason to insects, believing that "while the instincts of birds are perhaps less elaborate, their adaptive intelligence or reason and the strength and definiteness of their emotions are unquestionably far superior to those presented by the social insects." Moreover, the author logically claims that reason, imagination and volition are "mere higher developments arising out of previous processes," such as the automatic actions of the lower animals.

Bastian then describes the brain of mammals, especially Quadrumana, and claims that there is a progression in mental capacity from the lower mammals to the monkeys and apes: "The development of intelligence, emotion and volition, which becomes so obvious in lower Quadrumana, is, however, recognizable in a still more striking degree when we come to the so-called man-like apes, viz., the gibbons, the chimpanzee, the gorilla, and the orang-outang."

The concluding half of the book is devoted to the human brain and human psychology. The chief interest of the book to us is the fact so well brought out that the leading features of the mind of man have their germs in the mental processes of the lower animals, and that there is, on the whole, a progressive development from invertebrates to man.

Finally the author states his belief that "every higher intellectual and moral process—just as much as every lower sensorial or perceptive process—involves the activity of certain related cell-and-fibre networks in the cerebral cortex, and is absolutely dependent upon the functional activity of such networks." He claims that "consciousness or feeling must be a phenomenon having a natural origin, or else it must be a non-natural, non-material entity." On the other hand, he is decidedly opposed to the doctrine of automatism held by some extreme evolutionists, closing his book with these words: "But we certainly should not, on this account, allow ourselves to be mentally paralyzed by a belief in the existence of a metaphysical gulf between what is termed the subjective and the objective—the 'Ego' and the 'Non-Ego.' Yet, even some believers in the philosophy of evolution have thus been led to deny the natural origin of conscious states, and have, as a consequence, found themselves forced to hold a doctrine of thoroughgoing 'Automatism'—one in which all notions of free will, duty and moral obligation would seem, from this theoretical basis, to be alike consigned to a common grave, together with the underlying powers of self-education and self-control."

As to the moral nature, Bastian believes that it originated in savage life, after society developed, and says nothing as to the possible existence of the germs in the animals below man.

MASON'S MICROSCOPIC STUDIES ON THE CENTRAL NERVOUS SYSTEM OF REPTILES AND BATRACHIANS.[1]—The author here deals with the form of the spinal cord, and especially that of its enlargement; the nuclei of the nerve cells, and variations in their shape, size, etc., in the same individual: the number of ganglionic bodies in the spinal cord, and their relations to the roots of the spinal nerves, and the difference, if any, which may be determined by sex. After stating the methods of preparation of his sections, Dr. Mason, as a result of very extended examinations of a large number of what we can testify to be beautiful sections of the spinal cord of the frog and different reptiles, concludes as follows:

1. The central canal of the spinal cord of frogs is more nearly cylindrical in shape than has been generally supposed. The oval contour is not seen in cross sections below the second pair of nerves, when the membranes are not removed before hardening.

2. The nuclei of the large nerve-cells are more generally oval in form than are those of the smaller cells.

3. The nerve-cells of the crural enlargement are as abundant as those of the brachial enlargement, if not more so. Their nuclei are larger, as are also the surrounding masses of protoplasm or cell bodies.

4. No difference in structure can be made out in the upper portion of the cord, corresponding with the sexual function in the male. The long-continued and violent tonic spasms of the anterior extremities, must be explained by local hyperæmia influencing the same structure as those which exist in the female.

5. The relation which is generally believed to exist between the

[1] *Microscopic Studies on the Central Nervous System of Reptiles and Batrachians.* The spinal cord of the frog, *Rana pipiens, Rana halecina.* By JOHN J. MASON, M. D. (Reprinted from the Journal of Nervous and Mental Disease. Jan. 1880.) Chicago, 1880. 8vo, pp. 8.

so-called motor-cells and the inferior (anterior) roots, can be demonstrated in the frog more readily than in any other animal.

We shall look with much interest for future contributions by the author to our knowledge of the histology of the nervous system of the lower vertebrates, as it is a field greatly neglected in this country, Dr. Dean's monograph on the general subject not having been succeeded by similar works until the present time; these studies, moreover, have a great interest in connection with the views of Lewes and Bastian.

Recent Books and Pamphlets.—The Geology of Hudson county, New Jersey. By Israel C. Russell. (From the Annals of the New York Academy of Sciences, Vol. II, No. 2.) From the author.

The Antiquity of Man and the Origin of Species. By J. W. Dawson. (From the Princeton Review.) From the author.

List of papers communicated to the American Philosophical Society. By Pliny Earle Chase, LL.D. From the author.

The Mica veins of North Carolina. By W. C. Kerr, State geologist North Carolina. (From Transactions of the American Institute Mining Engineers, 1880.)

Topography as affected by the rotation of the Earth. By W. C. Kerr, State geologist North Carolina. (From Proc. Amer. Philos. Soc., 1873.)

Notes on the Vertebrata of the Pre-glacial Forest Bed Series of the East of England. By E. T. Newton, F.G.S. (Ext. from the Geological Magazine, Decade II, Vol. VII, No. 9, p. 424. London, 1880.)

Revision of the Land Snails of Palæozoic Era, with descriptions of new species. By J. W. Dawson. (From the American Journal of Science, Vol. XX, November, 1880.)

Bulletin of U. S. Geol. and Geog. Surv. Terrs. F. V. Hayden, Vol. V, Nos. 3, and 4.

Classification of the Cryptogams. By Alfred W. Bennet. Reformed System of Terminology in Thallophyta. By Alfred W. Bennett and George Murray. (From the Quarterly Journal of Microscopical Science, 1880.) From the authors.

Nouvelles Recherches sur les Poissons Fossiles, découverts par M. Alby A. Licata en Sicile. Par M. H. E. Sauvage. From the author.

Sur un Reptile très perfectionné, trouvé dans le terrian permien. Par M. A. Gaudry. (From Comptes Rendús de l'Académie des Sciences, Oct., 1880.) From the author.

De la Nécessité D'Une Zoographie Apropos de la Phytographie de M. A. de Candolle. Par Dr. E. L. Trouessart. (Extrait du Journal le Naturaliste, No. 31, 1er Juillet, 1880.) From the author.

The Gold Gravels of North Carolina; their structure and origin. By W. C. Kerr, State geologist N. C. (From Transactions of the Amercian Institute of Mining Engineers.) From the author.

Report of the Committe Mutual Improvement Society of Queenwood College, 1880.

Ueber Geusérs und nebenan entstehende verkieselte Bäume. Von Dr. Otto Kunke. (From Ausland, 1880.) From the author.

Sur le Terrain silurien supérieur de la presqu'ile de Crozon. Par le Dr. Charles Barrois. (Ext. Ann. Soc. Geol. du Nord, 1880.) 8vo, pp. 12, 1880. From the author.

On the Structure of the Orang Outang. By H. C. Chapman, M.D. (Proc. Acad. Nat. Sci. Phila., 1880,) 8vo, pp, 16, pls. 7. From the author.

The Placenta and Generative Apparatus of the Elephant. By Henry C. Chapman, M.D. (Jour. Acad. Nat. Sci., 1880.) 4to. pp. 10, pls. 4. From the author.

Beiträge zur Palæontologie von Oesterreich-Ungarn. Edited by Dr. Edm. von Mojsisovics and Dr. M. Neumayr, 1880. Prospectus. From the editors.

GENERAL NOTES.

BOTANY.[1]

Relation of Elevation to Change of Color in Flowers.—Having seen many speculations on elevation as occasioning a change in the color of flowers, and *Gilia aggregata* having been mentioned as an example, I will state that I found, this summer, at the border of Idaho and Oregon, lat. 47°, on Coplen's butte, a hill of considerable elevation, large numbers of specimens growing near each other, varying from almost scarlet to a nearly clear white. They seemed equally vigorous, and were so intermingled that no difference of slope or elevation would account for the variation. Near Hood river, Oregon, at a much lower elevation, I found only specimens of a deep pink, approaching crimson.—*Jos. W. Marsh, Forest Grove, Oregon.*

Insect-destroying Fungi.—Every one has doubtless often seen in the autumn and early winter, dead flies adhering to the ceiling and various objects in the room, and which, upon close inspection, are seen to be swollen, with the abdomen covered with a white powdery substance. Dissection of fresh specimens of such flies reveals a great number of short, colorless, branching non-septate hyphæ, whose granular protoplasm contains numerous oil globules. These hyphæ are the vegetative organs of a parasitic plant to which the name *Empusa muscæ* is frequently given, and under this name it may be found briefly described in many books on fungi. It is now, however, pretty well established that we have here again another instance of a very common mistake in cryptogamic botany, that is, a description and classification based upon a knowledge of only one stage of the plant. Cohn ten years ago suspected this to be the case, but it remained for Brefeld and Nowakowski to demonstrate it, which they did in 1877. The latest contribution to our knowledge of the group of plants to which the fly fungus is now referred, is by Giard (Deux espèces d'Entomophthora nouvelles pour la Flora Française) in the Bulletin Scientifique du Département du Nord.

The results of these several investigations are that the old genera Empusa and Tarichium are now to be considered as respectively, the asexual and sexual stages of low forms of the order Saprolegniaceæ, and Giard proposes that the two old names be retained to designate the stages, and that the much more applicable name Entomophthora, proposed by Fresenius, be used to designate the genus. The fly fungus will accordingly be known as *Entomophthora muscæ* Fres.

The life-history of the Entomophthoræ may be briefly summarized as follows:

1. *Empusa stage.*—The short colorless branching hyphæ ramify through the tissues of the host, their swollen extremities eventu-

[1] Edited by Prof. C. E. Bessey, Ames, Iowa.

ally coming to the exterior surface, where by constriction each gives rise to one or more spheroidal conidia. These conidia constitute the white powdery substance spoken of above. Conidia have been observed to germinate in water, sending out long thick hyphæ. Doubtless they serve in some way to quickly communicate the parasite from host to host, but the particular manner of their doing this has not yet been made out.

2. *Tarichium stage.*—In the same host which sustained the Empusa stage, or possibly in another, the hyphæ develop the sexual organs. These are similar to those found in other Saprolegniaceæ, and give rise to oöspores, which have thick and sometimes reticulated walls. The hyphæ and ripe oöspores occupy the cavity of the body of the host as a pulverulent mass. The oöspores (the hypnospores of Cohn) are disseminated by the decay of the body of the host, and after a period of rest reproduce the parasite again.

There are doubtless many species of Entomophthora in the United States, but so far as the writer is aware they have been but little studied.

Giard describes a species *(E. calliphoræ)* which is found in France parasitic upon *Musca (Calliphora) vomitoria;* and as this host is one of our common meat flies it is altogether likely that its enemy is to be found here also. The fungus long ago described by Leidy (although not named by him) as occurring in the abdomen of the seventeen-year Cicada, appears from his figures to be a species of this genus. Peck, in the Thirty-first Report of the N. Y. State Museum of Natural History, describes what is probably the Tarichium stage of the same parasite under the new genus Massospora, and says, "it apparently belongs to the Coniomycetes." The species he names *M. cicadina.* Probably the "muscardine" of the silk-worm (the so-called *Botrytis bassiana)* will be found to belong here also.

Bennett's Classification of the Cryptogams.—In the recent meeting of the British Association for the Advancement of Science, A. W. Bennett proposed a considerable modification of the classification given by Sachs in the fourth edition of the "Lehrbuch." The following sketch will convey to the student who is familiar with Sachs' work, a good idea of the proposed classification.

I. THALLOPHYTA.

Class I. Protophyta.

Sub-class Protomycetes.

Order *Schizomycetes.*

Under this order Saccharomyces is regarded as an aberrant form.

Sub-class Protophyceæ.

Orders, *Protococcaceæ, Nostocaceæ, Oscillatorieæ, Rivularieæ.*

Myxomycetes, a low group supplementary to the Protophyta, not exhibiting true sexual conjugation.

CLASS II. FUNGI.

Sub-class Zygomycetes.

Order *Mucorini*.

Sub-class Oömycetes.

Orders *Peronosporeæ* and *Saprolegniaceæ*.

Sub-class Carpomycetes.

Orders, *Uredineæ*, *Ustilagineæ*, *Basidiomycetes* and *Ascomycetes* (the last including the Sub-order *Lichenes*).

CLASS III. ALGÆ.

Sub-class, Zygophyceæ.

Orders *Pandorineæ*, *Hydrodictyeæ*, *Confervaceæ*, *Ulotrichaceæ*, *Ulvaceæ*, *Botrydieæ*, and *Congugatæ* (the last including the Sub-orders *Desmidieæ*, *Diatomaceæ*, *Zygnemaceæ* and *Mesocarpeæ*).

Sub-class Oöphyceæ.

Orders *Volvocineæ*, *Siphoneæ*, *Sphæropleaceæ*, *Œdogoniaceæ*, *Fucaceæ* and *Phæosporeæ*.

Sub-class Carpophyceæ.

Orders *Coleochæteæ* and *Florideæ*.

II. CHARACEÆ.

No change is proposed in this group other than separating it as one of the primary divisions of the vegetable kingdom.

III. MUSCINEÆ.

No change is proposed in this division.

IV. VASCULAR CRYPTOGAMS.

Isosporia.

Orders *Filices* (including *Ophioglossaceæ*) *Lycopodiaceæ* and *Equisetaceæ*.

Heterosporia.

Orders *Rhizocarpeæ* and *Selaginellaceæ*.

BOTANICAL NOTES.—Planchon reports the advent of the American grape mildew *(Peronospora viticola)* in the vineyards of France, and Pirotta reports its presence in the Italian vineyards in the Appennines.——Thomas Meehan has prepared a valuable paper on forests and forestry for the forthcoming Report of the State Board of Agriculture of Pennsylvania, the advance sheets of which have been received. After a careful personal examination of the forests of portions of Pennsylvania, Virginia, North Carolina and Tennessee, he concludes "that there is much more timber in the country than people generally believe, though at present in localities not convenient, as a general thing, to market at paying prices." He notes the great rapidity of growth in the trees of the region examined, as contrasted with their slow growth in Europe, and maintains that with proper care and culture, good paying timber can be grown in from fifteen to twenty years.——In the *Journal of Botany* for November, Henry Trimen has an interesting article "On the plant affording Cearà India rubber." It is a Brazilian tree *(Manihot glaziovii)* now grown in Ceylon, and it promises to become a valuable rubber-producing tree.——In the October *Bulletin* of the Torrey Botanical Club, Mr. Le Roy reports a remarkable case of duration of vitality of the seeds of an undetermined Cucurbit from Patagonia. Seeds from a specimen collected by the Wilkes Exploring Expedition between 1838 and 1842, were planted and successfully germinated the past summer.—In the same journal W. R. Gerard begins a "List of the State and local floras of the United States;" it gives the name, date and place of publication of all the important catalogues of plants ever published in this country. As such a list will be very useful to botanists, all who can should contribute to its completeness by communicating with the author, at 9 Waverly Place, New York city.——Botanists will be glad to learn that the publication of Dr. T. F. Allen's promising work, "Characeæ Americanæ" has been resumed. The parts now contain three plates each.——"A manual of the mosses of the United States" is said to be in course of preparation by Thos. P. James and Leo Lesquereux. The authors hope to publish it sometime during 1881.——Dr. Uhlworm's "Botanisches Centralblatt," which covers much the same ground as the well known "Botanischer Jahresbericht," by Dr. Just, promises to be more valuable than the latter in one respect at least, and that is in the greater promptness of its publication. Anderson, Farlow, Harvey, Lesquereux, Parry and Rothrock are the American contributors.——The papers in the last number of Pringsheim's *Jahrbücher für wissenschaftliche Botanik* are one by Bretfeld upon the healing of wounds, and the separation of the leaf from the twig; one by Müller upon the glands of the Cruciferæ; one by Tangl upon the open passages between the cells in the endosperm of certain seeds *(e. g., Strychnos nux-vomica, Areca oleracea* and *Phœnix dactylifera);* and one by Bachman upon the corky outgrowths upon leaves. ——The October number of the *Quarterly Journal of Microscopical Science* contains two botanical articles, viz: Bennett on the classification of Cryptogams, and Bennett and Murray on a reformed system of terminology of the reproductive organs of Cryptogamia. The latter will be more fully noticed hereafter. ——Thomas Meehan has been studying the question of the cause of the timber line upon high mountains (Proc. A. N. S. of Philadelphia, Sept., 1880). On Gray's peak the coniferous trees near the line of 11,000 feet are thirty to forty feet high, but at this line they cease as suddenly "as if a wood had been cut half away by a woodman's axe." Beyond the timber line the same species exist as dwarf, stunted trailing shrubs, often extending fifteen hundred feet higher up the mountain side. These stunted plants appear never to produce seed! Mr. Meehan's studies in the mountains of North Carolina and in the White mountains of New Hampshire, lead him to the conclusion that the stunted plants are the struggling offspring of trees which at no very remote period extended much further up the mountain than they do now. The reason for the disappearance of the large trees he believes to be due mostly to the disintegration of the rocks and the washing down of the earth from the higher elevations, thus starving the larger vegetation, while still affording conditions permitting the growth of smaller plants.

ZOÖLOGY.[1]

Notes on the Land-shells of Dominica.—Mr. Guppy, in the *Annals and Magazine* for 1868, has some remarks on the shells of Dominica, which are partly reproduced by Bland (*Am. Jour. Conch.*, Vol. iv., 1868). My stay in Dominica was too short to allow of a complete investigation of the conchology of the island, but was long enough to enable me to ascertain that Guppy's notes, especially as to the distribution of the shells, are extremely erroneous. He says, "on the lower slopes near the sea I found a few Mollusca, chiefly *Bulimus exilis*, *Stenostoma octona*, *Succinea approximans* and *Helicina humilis*. Ascending higher, we find *H. denticus*, *H. badia*, *H. josephinæ*, *H. nigrescens*, *Amphibulina patula*, *B. laticinctus* and *Heligina epistilia*. Excepting the last, all these species are found everywhere above 300 or 400 feet of elevation." The fact is that while the first-named species are found on the lower slopes, they are not all which are so found. *H. badia* and *H. denticus* are found abundantly in the gardens in Roseau, but disappear or occur but very sparingly above 800 feet, their place being taken by *H. nigrescens* and *H. josephinæ*, which I have never detected below 800 feet. My notes are necessarily imperfect, but through the kindness of my friend, Dr. H. A. Alford Nicholls, of Roseau, who is making observations and collecting for me, and by more extended collections which I hope to make in person this winter, I shall be able to add to them.

I append a list of the species, not as a complete list of the shells of Dominica, but only of those which I have myself collected.

Helix baudoni Petit.—So closely allied to *H. concolor* Fer., that I doubt its claim to specific rank. Not common. Road from Roseau to Rosalie; 2000 feet. I have not detected it on the lower slopes.

Helix badia Ferussac.—Abundant on the lower slopes down to sea level, but occurs very sparingly above 800 feet. All the specimens I have seen are smaller than those from Guadeloupe or Martinique.

Helix josephinæ Ferussac.—Quite abundant above 1000 feet. Last whorl more rounded than in the Guadeloupe specimens.

Helix denticus Ferussac.—Common on the lower slopes down to sea level; rare above 800 feet.

Helix nigrescens Wood.—Abundant above 1000 feet.

Bulimus virginalis Pfeiffer.—On trees 2000 feet; not common.

Bulimus multifasciatus Lamarck.—On trees 2000 feet; not common.

Bulimus exilis Gmelin.—Abundant below 1000 feet; occurs more sparingly above this height.

[1] The departments of Ornithology and Mammalogy are conducted by Dr. Elliott Coues, U. S. A., Washington, D. C.

Bulimus nichollsii Nob.—Quite common on road from Roseau to Rosalie; 2000 feet.

Stenogyra octona Chemnitz.—Abundant everywhere.

Tornatellina antillarum Shuttleworth.—Sparingly at about 500 feet.

Succinia approximans Shuttleworth.—Not common; 300 feet.

Succinia rubescens Deshayes.—Not common; 300 feet.

Amphibulina patula Bruguiere.—Not common; on bananas at Laudat; 2000 feet. Shell rather larger and more corrugated than the St. Kitts specimens.

Amphibulina tigrina Lesseur.—Rare, 1000 feet on bananas. I have not seen *A. pardilina* Guppy, but fancy it may prove this.

Cyclophorus schrammi Shuttleworth (?).—Quite common at 1500 feet. I can see no difference between this and specimens of *C. schrammi* from Guadeloupe. *Cyclotus amethystinus* Guppy, I have not seen, but from his own description it is evident that his shell is not a Cyclotus but a Cyclophorus, and presumably this species.

Helicina platycheila Muhlfeldt. Not common; 800 feet.

Helicina rhodostoma Gray. Not common; 1500 feet.

Helicina fasciata Lamarck.—Not rare; 800 feet.

Helicina antillarum Sowerby. Common everywhere, but most abundant in the lower slopes.

Bland (Ann. Lyceum, Vol. x, 1872) quotes a letter from Dr. W. J. Branch, of St. Kitts, to the effect that *Amphibulina patula* is unable to contract the entire animal within the shell, but expresses his doubt as to the truth of this observation. I have frequently seen the animal completely contracted within the shell in living specimens, although it is not its usual habit even when alarmed; if thrown into alcohol or glycerine, it immediately withdraws the whole body into the shell.

In giving the altitude at which the different species occur, I mean, that so far neither Dr. Nicholls nor myself have found them at any less elevation. Further search in which Dr. Nicholls is now engaged will undoubtedly extend their range, but I am quite confident that none of the species will be found to vary materially from these figures in their distribution as to elevation.—*A. D. Brown.*

Breeding Habits of the European as Compared with those of the American Oyster.—Regarding this interesting subject, we print the following extract from a letter from Capt. Francis Winslow, U. S. N., to Prof. W. K. Brooks, of Johns Hopkins University.

"U. S. S. Saratoga, Gibraltar, June 14, 1880.

"I got hold of some oysters in Cadiz a few days ago, and upon examining them found them in so favorable a condition that I attempted to fertilize the eggs according to your method, and I thought you might like to know that the experiment has been completely successful. The young are now eight days old, and are thriving wonderfully. I labor under a great many inconveniences, and against many obstacles, having only a couple of fruit jars to hold the animals, and a very poor little microscope, but it is sufficiently powerful to enable one to trace the course of development in a general way, and that I have done.

"Of course I have a good many other duties, and since our arrival here I have been trying to find out some things about the sub-current in the Straits, consequently I could not give the oysters all the attention I desired, but I have followed them through each step as nearly as possible, and they have been exactly as you have figured for the American animal. I have seen them assume the form of each figure or set of figures[1] successively, and they are now about as your last figures show them. I shall watch them as closely as possible henceforward, though the necessity for transferring them to a larger vessel, may prevent my continuing the observations, and as we sail to-morrow, a gale of wind may send my young brood afloat again in the briny ocean. I think my success is due to the uniform temperature of my room where I have kept the jars. Though I have not registered it, yet it must be nearly the same at all times, for I am personally aware that the atmosphere is rarely changed in any way. The brood is the offspring of two males and two females, and the whole lot which I examined appeared exactly as did those we are familiar with. The adults came from the waters of Cadiz bay, and are natives.

"So far as these results go, they prove that the artificial propagation of the European oyster is practicable to just the same extent as our own, and I think that it throws grave doubts upon the theory that the embryo is protected within the shell, and that the impregnation of the ova occurs there and nowhere else.

"I am quite elated over my success, and thought that probably it would interest you, and therefore have written. I have made but one deviation from your method, and that was in the supplying of water. I have given but very little new water, rarely a gill and a half a day. I am very truly yours, FRANCIS WINSLOW."

CHANGE IN THE NERVOUS SYSTEM OF BEETLES DURING METAMORPHOSIS.—This subject has been studied with great thoroughness of detail in text and illustration by H. Michels. (See the Zeitschrift für wissenschaftliche Zoologie for September 10, 1880.) The figures are the most important ever given, supplementing and greatly extending Newport's celebrated figures of the changes in the sphinx from the caterpillar to the moth, as well as Weismann's researches on the flesh fly. Michels concludes that the separate ganglia of the ventral cord of the pupa and imago are formed during metamorphosis from the larval stage, not *de novo*,

[1] See Prof. W. K. Brook's, the Development of the Oyster. Studies from the Biological Laboratory of Johns Hopkins University.—*Eds.*

but that the different ganglia persist from the larval state. The peripheral nerves also persist or survive from the larva to the beetle (the species studied was *Oryctes nasicornis);* besides there is an increase in the number, or accession of new nerves different from those in the larva, and peculiar to the beetle.

A *punktsubstance*, in Leydig's sense, appears to be wanting, as also the transverse commissures usually uniting the hemispheres of a ganglion. In place of the latter are extraordinarily numerous transverse bundles of fibers which, arising from the ganglion cells of one side, form the peripheral nerves of the other side, and also a bundle which passing through the interlacing of each half of the ventral cord, assumes three longitudinal directions. These nerve-fibers running parallel to the axis pass continuously from one end of the ventral cord to the other, forming in fact the longitudinal commissures of the ventral cord. These commissures take their origin neither out of a central punktsubstance, nor from a peripheral ganglion mass, but are mere continuations of longitudinal nerve-fibers decreasing posteriorly in thickness, and which extend through the œsophageal ring commissures to the brain.

A New Genus of Catostomidæ.—Prof. D. S. Jordan, informs me that the dentition of his genus *Chasmistes* is identical with that of *Catostomus*. The two species from Klamath lake, Oregon, described by me under the names of *Chasmistes luxatus* and *C. brevirostris* (American Naturalist, 1879, 785), exhibit a different type of dentition. The pharyngeal bones are very slender and are flattened, and their teeth are minute and very numerous, as in *Carpiodes*. The genus thus defined will stand in the *Catostomine* division, and next the *Bubalichthyinæ*, and may be called Lipomyzon.—*E. D. Cope*.

Cellular Irritability.—M. Richet in the *Revue Scientifique*, gives the following synopsis of the effects of stimuli on simple animal and vegetable cells. (1) Oxygen is necessary, and there is consumption of oxygen during the life of the cellule. (2) The intensity of movements grows with the temperature, up to 40° C.; above 40° the movements disappear. (3) Neutral solutions slightly alkaline are favorable; acid solutions are fatal. (4) All change of condition is a stimulant to the cell, and consequently provokes its contraction. (5) But this change of condition must be abrupt, for, if gradual, it does not provoke reaction. (6) The reaction from the stimulus is not sudden, but there is a period of "latent excitement" which diminishes in proportion to the intensity of the excitation. (7) Weak stimulation, powerless when isolated, becomes effective when frequently repeated at short intervals.

Budding in Free Medusæ.—The germination of the young from the walls of the proboscis of *Lizzia octopunctata* Forbes, seems to me to throw some light on a theoretical question of "alternation of generation" in Willia, raised by Dr. Brooks in the September number of the NATURALIST. *Lizzia octopunctata* produces young by budding from the time she is herself attached to the parent until she acquires the form as figured by Forbes. After that time reproduction by gemmation, in the restricted sense of the word, ceases, and a sexual method takes its place. I have studied one of these Lizziæ in which the eggs had begun to form while yet buds were attached to the proboscis of the same. Can we not, therefore, instead of considering that there are two separate forms of Willia, one of which forms a new generation asexually, and another which reproduces by the egg, suppose, as is the case in Lizzia, that in the same individual, after the asexual method ceases, we have as final products of the somewhat similar process, the formation of eggs which, after contact with the sperm, pass through a sexual development?

If there are two forms of *Willia ornata*, they may be simply male and female. Was the "second form" of Willia, spoken of by Dr. Brooks, male or female? Before its sex is known, the theory of "alternation of generations," which he advances, is premature, and when it has been shown that the "second form" is a female, it remains to be demonstrated that the asexual "first form" does not ultimately develop into the second which lays eggs.—*J. Walter Fewkes, Cambridge, Dec. 6, 1880.*

ZOOLOGICAL NOTES.—Prof. Ercolani has recently studied the placenta of cartilaginous fishes, and of mammals, with reference to classification and anthropogeny. Another Italian, Prof. Ciaccio has communicated to the Academy of Sciences of Bologna the results of his examination of the intimate structure of the eyes of Diptera, and also those of a blind Talpa.——Mr. Swinton's book on "insect variety" is not favorably reviewed by *Nature*; though it is said to be full of original observations. It is devoted mainly to the subjects of mimicry, odors, dances, colors, music, and insect variation.——A writer in *Nature* confirms Mr. Ober's statement in his "Camps in the Caribbees," as to the singular habit of the gnat beetle, *Dynastes hercules*, which seizes hold of a branch of a tree, and whirls around by its wings until the limb is severed. Mr. Ernst, of Caraccas, says the beetle wants to get at the abundant juice of the young branches. He adds that the *Golofa porteri*, an allied insect of the same family, behaves in a similar way, but chooses of course thinner branches.——The *Zoologischer Anzeiger* for November 1, contains the conclusion of Studer's notice of sexual dimorphism in Echinoderms.——The structure of the poison apparatus of spiders has recently been studied by J. MacLeod of Belgium.——About 7800 species of Heteropterous Hemiptera had been described up to the year 1879, while up to 1859 about 3000 species of Homopterous Hemiptera had been catalogued. Mr. Uhler has estimated that there are probably not less than 10,000 species of North American Hemiptera.

ENTOMOLOGY.[1]

[SALUTATORY.—Having decided to discontinue the publication of the AMERICAN ENTOMOLOGIST, we hope to transfer the interest it represents to the pages of the NATURALIST, and bespeak for it the support of the subscribers and contributors to the first-named magazine. We shall not lose sight of the economic bearings of entomology, and hope to make the NATURALIST a welcome visitor not only to the student of insects, but to him or her whose principal anxiety is to protect from the injuries of these tiny marauders whether flower, fruit, cereal, shade tree or other product. As in the columns of the *American Entomologist*, we shall here consider and answer such questions as are of public interest, and we invite correspondence alike from the practical man, the amateur and the specialist. Separate copies of contributed articles will be furnished when required. We will also send the complete volume of the *American Entomologist*, just brought to a close, to any one desiring it, upon receipt of the club subscription rate, $1.50.—*C. V. R.*]

BIOLOGICAL NOTE ON EUPLECTRUS COMSTOCKII Howard.—During my stay in Selma, Ala., engaged in work for the U. S. Entomological Commission, from the end of August till October 12th of this year, I had ample opportunity to observe the above named interesting parasite of the cotton worm, and the following notes on its life history may, perhaps, prove not without interest, though they contain nothing new beyond Fonscolombe's observations on this and allied genera of Chalcididæ.

Though I often saw the perfect parasite on the leaves of the cotton plant, I never was fortunate enough to observe the act of egg-laying, and am, therefore, unable to state the length of time necessary for the egg to hatch. All the eggs which came under my observation always hatched either the same or the next day. Judging, however, from the rapid development of the insect under consideration, it is more than probable that the time elapsing from the laying of the egg to the issuing of the parasitic larva, does not much exceed two days. The egg is elongate-oval, strongly convex above and somewhat flattened beneath; no sculpture is visible under an ordinary lens. Its color is uniformly brown, and almost black just before hatching. The number of eggs laid by the female Euplectrus on a single Aletia larva, I found to vary from one to fifteen, the most common numbers being three, five and seven. They are always laid in a group, but the individual eggs sufficiently separate from each other to allow room for the development of the larvæ. In one instance I found two separate egg-groups on an Aletia larva, and these were, in all probability, laid by two females of Euplectrus. When only one or two eggs are found upon a worm, the presumption is that the

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., may be sent.

latter has been able to remove one or more of them, or that they dropped off from one cause or another. Eggs that have failed to hatch but that adhere to the worms are sometimes met with.

The Aletia larvæ attacked by this parasite are usually less than one-third grown, but not less than one day old. Exceptionally they are rather more than one-third grown. The eggs of the Euplectrus are usually laid on the middle of the back of the worm, sometimes a little more in front or behind or more towards the sides, and in one instance I saw them fastened immediately above one of the middle pair of thoracic legs.

The delicate egg-shell splits longitudinally in the middle of the back and discloses the white larva of the parasite, which gradually works the egg shell more and more down the sides of its body where, for some hours, it remains visible as a black line, but within less than twelve hours it disappears from view beneath the rapidly growing parasite larva. This last, as soon as it has freed its head from the egg shell, pierces the skin of its victim and thereafter remains stationary with its head buried. As soon as it has fairly begun to feed, the white color changes to a bright bluish-green, and the segments and spiracles which in the newly hatched larva were barely visible under high magnifying power, are now readily seen. The growth of the larva is very rapid, but seems to vary according to the season, averaging three days in August and four days in September. When full-grown the larvæ crowd each other, and if there are five or more of them on a caterpillar, they form a semi-globular lump of very striking appearance. Usually their growth is uniform, and retardation in development of individuals in the group results in death. When full-grown they turn yellowish-white and relax their hold.

The worm which up to this time showed no signs of being affected, except by its sickly yellowish color, and by its very slow growth, collapses and dies as soon as a single one of the parasitic larvæ withdraws, and the same fate overtakes those Euplectrus larvæ which are at the time less advanced in their development, or immature. If one of the parasitic larvæ be removed by hand, both the victimized worm and the remaining parasites quickly dry up.

The presumption that the Euplectrus larvæ may migrate from one worm to another is unfounded, they always remain stationary on the worm, which the parent fly has chosen as its victim, and they never even move from the spot where the egg has been laid until they are full grown. Every attempt I made to transplant a larva from one worm to another invariably resulted in the death of the parasite.

In preparing for pupation, the larvæ manage by a peculiar elongation and sudden contraction of their abdominal joints to work from the back of the worm to the ventral or attached side where they spin fine silken threads, which more fully secure the worm, which is now a mere empty skin, to the leaf. As the Euplectrus larvæ take their places side by side, the caterpillar skin is fastened its whole length to the leaf if there are five or more of the parasites, but if there are fewer only one portion of the skin, usually the anterior end is fastened, the remaining portion either hanging down or breaking off. This web of the Euplectrus larvæ consists of an irregular mesh of yellowish-white silk, recalling some kinds of mold, and spun to secure the caterpillar skin to the leaf, in addition to a few other threads to prevent the pupa from being moved from its place. This web should not properly be called a cocoon, its character is excellently expressed in Fonscolombe's words as quoted by Westwood[1]: "larva * * * ad metamorphosin filis aliquot sericis longiusculis crispis inordinatis involvitur."

Protected by the caterpillar skin as by a roof, the Euplectrus larva changes to the pupa, the color of which is dark honey-yellow, with the head and abdomen very soon becoming pitchy black. The duration of the pupa state varies from three to eight days.

The Euplectrus is subject to the attacks of a secondary parasite of its own family, and its pupa is sometimes destroyed by another enemy, probably some Carabid beetle.

Cotton worms infested with the Euplectrus were by no means rare during the month of September, and the almost complete destruction of the worms in the earlier part of October was principally due to this parasite, and to a species of Microgaster hitherto unmentioned as a parasite on Aletia.—*E. A. Schwarz, Washington, D. C.*

Oviposition in the Tortricidæ.—The remarks on this subject by the editor, in the November number of the *American Entomologist*, suggest that the observations I have made on the life history of *Tortrix fumiferana* Clem., may possibly be of interest.

I have been endeavoring for several years to carry this insect through all its stages, but have not yet been able to complete all the links in the chain. It was originally described by Clemens in 1865, under the above name, but doubtfully referred to the genus Tortrix, the type being the more common form of this variable species. Robinson seems to have overlooked this insect among the types of Clemens and re-described one of the reddish-brown varieties under the name of *Tortrix nigridea.*

Some three years ago I was informed that "worms in prodigious numbers were utterly destroying the evergreen forests" in some parts of this State, and a box of them, enclosed with some of the twigs, was sent to me, but was not received until after they had emerged and crawled over and among the twigs till they were denuded past recognition.

[1] Introd. II, p. 163.

The next year, however, I was able to get them sent to me in the larva and pupa states and had them emerge in confinement. Many, however, proved to be parasited and a large number of specimens of *Pimpla conquisitor* Say, together with several dipterous parasites and a hair-snake emerged from them. I could not convince myself that there was any difference in the activity of the larvæ, although nearly half of them finally proved to have contained parasites of large size.

The pupæ were kept in a glass observing cage, and soon after their emergence the sexes began to pair, quite irrespective of the time of day, some early in the morning, others in the middle of the day, and still others in the evening. It must be remembered that all my observations were made upon them in confinement, and that in nature, under different conditions, the ways of these insects *may* be somewhat different.

Having now a considerable number of impregnated females, they were disposed of so as to oviposit under different conditions. For one, a branch of fir (*Abies balsamea*) was supplied, this being their favorite food plant; others were put in dark boxes, while others were kept under glass beakers with no food plant.

The one provided with the branch of fir laid her eggs July 5th, about the middle of the forenoon. The manner of ovipositing was as follows: crawling upon the upper side of a leaf with her head towards the stem, she bent her abdomen down, depositing an egg a little to one side near the tip, then bending the abdomen a little to the other side she deposited another slightly overlapping the one already laid, then moving forward a bit and turning the abdomen to the other side another was laid, and so on till two continuous rows were laid upon the upper side, continuing to the base of the leaf, the eggs of the same row overlapping each other so much that not more than one-third of the upper side was free, while those of one row overlapped those of the other row by about a fourth of their width. After having finished the rows on one leaf, she went to another and continued as before, till one hundred and twenty-five were deposited.

The time required for the deposition of an egg was not far from five seconds, and the female continued her work almost without interruption till all those on one leaf were deposited; then an interval of a few minutes elapsed before she began on another.

The eggs are flattened, slightly elliptical, $1\frac{2}{5}$ mm. long and 1 mm. wide, of a bright green color, surface smooth under an ordinary lens.

I carefully watched another female with a lens, while ovipositing on the inside of a thin glass beaker. The abdomen was raised after the deposit of the egg and bent a little to one side, as described above, for the purpose of depositing a second egg; only in this case the eggs were not confined to two rows, but varied in number till as many as six or more rows were laid, forming an irregular patch, apparently without order, sometimes entirely overlying each other so that it was impossible to make an exact count, but the mass contained not far from the same number as in the other case.

The opening to the ovipositor, immediately after the expulsion of an egg, opened and closed several times, the external side parts moving laterally, after which the abdomen was bent down, the opening distended and an egg excluded. There was no movement of the parts to arrange or place the egg, nor was there any further manipulation of the egg, on the part of the female, but at once the abdomen was raised, the usual movements of the opening and closing the orifice took place, when the apex was again bent down and another egg laid.

The eggs laid on the 5th of July began to show a dark spot near the free end about the 10th, which grew more and more visible till the 13th, when with the lens the dark spot showed itself to be the head of the embryo, and the green contents within could be resolved into the outline of the body doubled up. On the 15th of July, the young emerged, and a more restless lot of larvæ I do not remember to have seen.

These young do not eat the shells of the eggs as some larvæ do, but travel away from them as though their lives depended upon it. Finally some of them settled down in the axils of the leaves, spinning a few silken threads over and between the leaf and the stem. For a week they were quiet and I could not perceive that they had eaten anything since hatching. They had even lost the green color of the body and were now dull ochre yellow, except the head and thoracic plates, which were, as before, pitchy black.

At this time I transferred them to a living fir tree, but all died within a day or two, possibly because of the rough handling necessary to dislodge them.

If we may be permitted to *conjecture* the rest of their life history, they possibly spin themselves up in a cocoon in the axils of the leaf, where they remain during the fall and winter, coming out in the spring to feed up and pass through their later transformations.

The full-grown larva is 20 mm. in length, somewhat fusiform. Head of the ordinary form, jet black, as are also the middle joints of the antennæ, the legs and thoracic plate. The remaining joints of the antennæ, palpi, integument between the joints of the legs, mouth parts, front edge of the thoracic plate, and a narrow longitudinal line dividing the plate in two halves, dull light green. General color of the body above, dark brown, inclining to greenish-yellow between the segments. Tubercles, anal plate and prolegs, straw-yellow. A lateral yellowish stripe extends from the head to the last segment, having the stigmata in the center and enclosing on the lower side, the lateral folds of the segments, and in its upper edge, the second row of tubercles from the dorsum.

The anal plate is somewhat roughened and sparsely clothed with stiff, yellowish hairs. Tubercles also surmounted by yellowish hairs. Underside dull greenish-brown, darker brown on the segments under the lateral fold.—*Prof. C. H. Fernald, State College, Orono, Maine.*

Supplementary Note on the Food of the Blue-bird.—When my paper on the food of the blue-bird was prepared for the September and October numbers of the *Entomologist,* I had no material illustrating the food of the species for the months between July and December, except two stomachs taken in September, the contents of which were so far exceptional that I excluded them from the table of the food. Since the publication of that paper I have studied the food of the blue-bird in August and September, and find the record for those months so different from that of the months preceding that an exact idea of the economical relations of the species cannot be given without taking it into account.

Twelve specimens were obtained in August at Normal, Ill.—three early in the month and the others on the 29th and 30th. The blue-birds were at this time most abundant in meadows and pastures, and the contents of their stomachs indicate that the chief business of the month was the pursuit of locusts, crickets and grasshoppers, moths and caterpillars.

The Orthoptera eaten by these birds amounted to fifty-eight per cent. of their food, and the Lepidoptera to twenty-seven per cent. About half of the former were Gryllidæ (Gryllus and Nemobius), and the remaining half were equally Locustidæ and Acrididæ (*Xiphidium fasciatum* and *ensifer*, *Caloptenus femur-rubrum* and *bivittatus* and *Œdipoda sordida*).

Half of the Lepidoptera were unrecognizable moths, and the remainder caterpillars, five per cent. being Noctuidæ. Ants were about one per cent. of the food, Coleoptera only five per cent. (including three per cent. Harpalidæ), Cydnidæ (*Cænus delia*) one per cent., and spiders six per cent. A few wild cherries and elder berries were the only fruits taken. The beneficial elements thus amount to about nine or ten per cent. of the food, and the injurious elements to about eighty-five per cent.

All but one of the ten specimens upon which the account of the September food is based, were shot at Normal, and all but two on the twenty-ninth of the month. The chief peculiarity of the month is the almost total disappearance of Coleoptera, which were represented only by a few small Harpalids and a single minute Atænius. The Lepidotera rise to thirty-seven per cent. chiefly through the abundance of the larva of *Prodenia lineatella* Harvey. The Orthoptera make just half the food, the species differing from those of the preceding month mainly in the greater number of red-legged locusts. Spiders were only two per cent. of the food, and some unknown wild fruits formed seven per cent.

It will be seen that a striking change in the food of this species attends the increase of the Orthoptera in numbers and activity, which occurs in the late summer and early autumnal months, these insects being almost entirely substituted for Coleoptera, Hemiptera and Arachnida. The Coleoptera of the six preceding months averaged twenty-seven per cent. of the food, while this order amounts to but three per cent. in August and September. The Orthoptera of the foregoing months averaged but fourteen per cent., while those of the two months in question rise to fifty-four per cent. As a consequence of this seasonal change, the most important general averages for the year given in the table on page 234 of the October *Entomologist*, should be amended as follows:

The Coleoptera drop from twenty-five per cent. to twenty, the Harpalidæ lose one per cent, and the Scarabæidæ two per cent.; Hemiptera, Arachnida and Myriapoda each also drop one per cent.; Orthoptera rise from twelve per cent. to twenty-one, and Lepidoptera from twenty-four per cent. to twenty-six. The grand total of injurious elements stands, as amended, at fifty-one per cent., and of beneficial elements at twenty-three. It is evident from the foregoing, that Orthoptera and smooth caterpillars are the favorite food of this bird, and as the first of these remain abundant until frost, it is not likely that the food of October is much less favorable to the bird than that of September. The two specimens taken in the former month were well filled with winged ants.—*Prof. S. A. Forbes*, *Normal, Ill.*

[Prof. Forbes is carrying on a most important work in his systematic studies on the food habits of birds. He is really making the first serious and accurate study of the subject attempted in this country, and the results in the end cannot fail to set at rest many of the questions constantly raised by the ornithophiles on the one hand and the fruit and grain growers on the other. The question is one that interests alike the entomologist, the ornithologist and the husbandman. It will be well to remark that in the October number of the *Entomologist* alluded to in the above communication, which is supplementary thereto, the totals in his table summarizing the observations made, were as follows:

SUMMARY OF THE FOOD OF THE BLUE-BIRD.

		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Ratio of each element to whole of Food.
No. of Specimens Examined.			10	21	13	9	10	9		2			12	86	
KINDS OF FOOD.		Number of specimens and Ratios in which each Element of Food was found.													
Percentages for Each Month	Beneficial Elements. .		.46	.28	.21	.35	.38*	.14					.11	.28	Totals for the Species.
	Injurious " .		.41	.60	.23	.55	.26	.67					.02	.39	
	Neutral "		.13	12	.56	.10	.34	.19					.87	.33	

* Includes 8 per cent. fruit.

ANTHROPOLOGY.[1]

Matériaux pour l'Histoire de l'Homme.—We are in receipt of *Livraisons*, three, four and five of this eminent periodical, and would call attention to the following articles: M. Gaudry has just published at Paris "Matériaux pour l'Histoire des temps quaternaires: second fascicule, F. Savy, 1880, p. 63 à 82. Pl. XII à XV." A short review of this work will be found in Matériaux, pp. 112–118, in which especial attention is invited to the occurrence of *Saiga tartarica* in the remains of the reindeer period. On page 127, is an abstract of a paper by H. Fischer in *Archiv für Anthropologie* upon the so-called Amazon stones and upon that fabled people. The author dwells especially upon the researches of M. Barbosa Rodrigues upon the tributaries of the Amazon, embodied in a work entitled, "Antiquités des Amazones, armes et instruments en pierre. A stone charm perforated longitudinally, called *muirakitan*, is spoken of as having great potency, resembles closely a series from Porto Rico, described by the editor of these notes in the Smithsonian Report, 1876, p. 378. fig. 30.

On page 201 is reproduced a paper prepared by J. J. da Silva Amada, professor in the school of medicine of Lisbon, upon the ethnogeny of Portugal. This publication was very timely, as it placed the readers of the *Révue d'Anthropologie* and of *Matériaux* in possession of sufficient knowledge concerning the general history of Portugal to listen intelligently to the papers before the International Congress of Anthropology and Prehistoric Archæology held this year in Lisbon.

A brief sketch of German anthropology begins on p. 220, but the only part of any importance is a very interesting account of the Kanikars, by M. Jagor. These people are a diminutive negroid race in Southern India, having crispy hair and living in huts among the trees, when they are in danger from tigers, wild boars, or elephants.

M. Piette proposes, p. 233, a new nomenclature, for archiethnologic races. Primarily we have the division into agrentic (hunters) and georgic (tillers of the soil.) The former is again divided into the barylithic and the leptolithic; the latter into the neolithic, the calcentic, and the protosideric. The editor of *Matériaux* wisely remarks that the public will decide whether any of these terms are happily chosen.

Anthropology in Austria.—The *Mittheilungen der Anthropologischen Gescellschaft in Wien*, Band x, Nr. 1–7, contains the following papers: Bericht über die Versammlung osterreichischer Anthropologen und Urgeschichtsforscher am 28 und 29 Juli, 1879, zu Laibach, by Dr. M. Much; Weitere methodische Studien zur Kranio-und Kephalometrie, by Prof. Moriz Benedikt; Die Sage von Orpheus, Orfen des Rhodope-Bulgaren, by Prof. Geitler; Die

[1]Edited by Prof. Otis T. Mason, Columbian College, Washington, D. C.

Juda in den Mythen der Balkanvölker, by Prof. Geitler; Neuere ethnologische Entdeckunken auf der Balkanhalbinsel, by Dr. Fligier.

Anthropology in Italy.—In the second fasciculus of the tenth volume of "Archivio per l'Antropologia e la Etnologia," we have the following original papers: Studii Antropologici sui Lapponi, by Paolo Mantegazza and Stephen Sommier; Materiali per l'Etnologia Italiana, Riassunti e commentali, by Dr. E. Raseri; Appunti sulla Etnologia del Madagascar, by Prof. Arturo Zannetti; Il Processo Paroccipitale e la Pars Mastoidea del temporale dei Mammiferi nell'Uomo, by Dr. Guiseppe Amadei. The first named paper is illustrated with ten very finely executed photographic plates.

Archiv für Anthropologie.—The twelfth volume of this notable Journal closes with the number for August, 1880. The leading communications bear the following titles: Ueber die Berechnung des Schädelindex aus Messungen an lebenden Menschen, by Dr. Ludwig Stieda; Die Metallarbeiten von Mykenä und ihre Bedeutung für die allgemeine Geschichte der Metallindustrie, by Christian Hostmann, in Celle; Zur Hohenmessung des Schädels, by Dr. J. Geldmeister; Bemerkungen über die Squama ossis occipitis mit besonderer Berücksichtigung des "Torus occipitalis," by W. Waldeyer, Table IX, Figs. 1, 2; Der Trochanter tertius des Menschen nebst Bemerkungen zur Anatomie des Os femoris, by W. Waldeyer; Ueber Timur's (Tamerlans) Nabstein aus Nephrit, by H. Fischer. Under the subject of reviews, we have some most valuable contributions to anthropological literature, to wit: Berichte aus der russischer Literatur über Anthropologie, Ethnographie, und Archäologie für das Jahr 1878, by Dr. Ludwig Stieda, of Dorpat. This is a continuation and the close of a communication from page 382 of the Archiv. It is exceedingly valuable, containing thirty-eight pages of closely printed matter, embracing titles of works in full with brief summaries of their contents. This paper is followed by a similar one upon Scandinavian anthropological literature, by Miss J. Mestorf, including much longer reviews upon publications in Denmark, Sweden and Norway. The crowning glory of the number, however, is a catalogue of recent anthropological literature, mostly in 1878 and 1879, by H. Müller, covering one hundred and fifty-three closely printed pages, and in many instances giving brief, pithy digests of the contents of the work. Such lists are valuable in a double sense. They enable specialists to find out what is being written on their favorite theme, but, better still, they give an *ensemble* of the scope and minutiæ of our science. Said a distinguished physicist to the editor of these Notes, upon reading over the list of titles published in the Naturalist, "I really had no conception before of the rapid strides which this last of the sciences has been making."

Anthropology in Mexico.—The *Anales del Museo Nacional de Mexico*, has reached the second part of Vol. II. This number is devoted entirely to Mexican Archæology, containing the following papers by the three most eminent specialists in the Republic: 1. Historia de los Mexicanos por sus pinturas; articulo por el Sr. D. Joaquin Garcia Icazbalceta. 2. La piedra del Sol, segundo estudio, por el Sr. D. Alfredo Chavero (continuacion). 3. Codice Mendozino, Ensayo de descifracion geroglifica, por el Sr. D. Manuel Orozco y Berra (continuacion).

British Periodical Literature and Anthropology.—Absence from one's sources of information for a few months accumulates literary material very rapidly. The three London periodicals, *Nature, The Athenæum*, and *The Academy*, gather up nearly all that is valuable in British anthropology and we give below the titles of articles and reviews that have appeared in these Journals from June 1 to October 1.

Reference to *The Athenæum*. The Survey of Palestine, June 19. Hittite Notes, by W. St. C. Boscawen, August 14. The Ethnical Relations of the Typical Man of South Wales, by Mr. F. W. Rudler, opening address before the Subsection of Anthropology in the British Association, also a review of Prof. Boyd Dawkins' address on "Primeval Man," and Mr. Francis Galton's lecture on "Mental Imagery," September 4.

Reference to *Nature*. A Scottish Crannog, with illustrations, May 6th and 13th. ["A full report of the Lochlee Crannog is given in Vol. XIII of the *Proceedings* of the Society of Antiquity of Scotland, and in Vol. II of the collections of the Ayrshire and Wigtownshire Archæological Association."] Abstract Report of Prof. Flower's Lectures on the Comparative Anatomy of Man, delivered at the Royal College of Surgeons, May 20th, May 27th, June 3d. Cup Stones, Cup-marked Stones, or Cups and Rings, May 27th, June 3d, June 10th, July 8th. Reviews of Prof. Dawkins' "Early Man in Britain and his place in the Tertiary Period," and of Principal J. W. Dawson's "Fossil Men and their Modern Representatives," May 27th. Review of Col. Mallery's Sign Language, June 3d. Review of Prof. Humphrey's Rede Lecture on Man, June 3d. Tribute to Dr. Paul Broca, July 29th. Address of F. W. Rudler, V. P. of Department of Anthropology, British Association, on the population of Southern Wales, September 2d.

References to *The Academy*. South European Folk-Lore, August 21st. The Earliest Rock-Hewn Monument in Asia Minor, by A. H. Sayce, August 28th.

Comparative Theology.—Under this title we include all discussions concerning the opinions which the different peoples of our globe have held respecting the first causes of phenomena, the nature of the soul and the phases of its existence after death, morality, worship, and sacred records. The latest utterance upon this branch of anthropology is one of the most charming books we have ever read, entitled, "The Origin and Growth of Religion as illustrated by the Religion of Ancient Egypt. By P. Le Page Renouf. The Hibbert Lectures for 1879," published by Charles Scribner's Sons. The author prepares us for a proper comprehension of his theme by seeking to remove "those prejudices which incapacitate us from forming true judgments on systems alien to our own habits of thought." The first two lectures are entirely devoted to the treatment of those subsidiary questions which clear the way for the proper comprehension of the subject, such as the history of the decipherment of the hieroglyphics, the religious nature of the texts, Egyptian chronology as set forth in lists of sovereigns, genealogies and later writers, and including also prehistoric antiquity, ethnography, language, art, moral code, caste, and marriage customs. In the third lecture begins the special treatment of the subject. And the first thing that strikes us is the fact that for three thousand years we have a religion unchanged in its salient features. In the temple of each province, from early times, triads and enneads occur. As each locality had its own deity, it came to pass both that one god was worshiped in different aspects, and different gods were treated as the same divine person. This reminds us of the fashion among our own Indians of using the same animal in various tribes under different names as the head of their respective gentes; but these sacred animals are not the same in passing from one tribe to another. This inextricable confusion is simplified in the gods of the first order by reducing them to two categories: 1. Rā and his family; 2. Osiris and his family. Ra, the sun-god, is borne across the sky in a boat, he proceeded from Nu (the sky), the father of the gods. His adversary is Apap (darkness). Shu (the air), and Tefnut (the dew) are the children of Ra. Osiris (the sun), is the eldest of five children of Seb (the earth, also the goose), and Nut (the heaven mother). He wedded his sister Isis while in his mother's womb, and their offspring was the elder Horus (the Sun). Seb and Nephthys, another wedded pair, are their brother and sister. Seb slays Osiris, who, being avenged by Horus his son, reigns in the nether world. The discussion of monotheism in this chapter, pp. 92–96, the interpretation of the Egyptian word *nutar*, Power, pp. 96–108, and the Reign of Law, under the title of Maat, are among the best pieces of work in the book.

The fourth lecture is devoted to the rites of burial, the construction and ornamentation of their tombs, the *Ka* or genius, religious endowments, the material form and substance of the soul, possession, dreams, oaths, omnipresence of the gods, angels, destiny, and the divine vicegerency of the king. The religious books of Egypt are the theme of the fifth lecture. Chief among these is the so-called "Book of the Dead." It is indeed no book at all; but a collection of chapters at first handed down by tradition, but afterwards committed to writing. They were supposed to be recited by the deceased person himself in the nether world, but were really said by those present at the funeral. These chapters are in papyrus rolls, on coffins, mummies, wrappings, statues and walls. The longest is the papyrus of Turin containing one hundred and sixty-five chapters. The chief subject of each chapter is the beatification of the dead, including renewed existence on earth, transformation into every desired shape, the range of the universe, and identification with Osiris and other gods. The use of amulets was carried to great excess: the scarabæi so frequently mentioned among ancient relics belong to this class. The lecture closes with a tribute to the moral doctrines of the Egyptians, in which the author repudiates the connection of the symbol of life with phallic worship. The religious systems are discussed in the last lecture under the title of hymns, Henotheism, Pantheism and Materialism.

The author while exhibiting the most excessive modesty is among the foremost Egyptologists, and does not fear to call Mr. Spencer, Mr. McLennan, and the champions of Dr. Thomas Young to order. One misses throughout the work formal classifications of myths and deities which would be exceedingly helpful to the student. A few outline drawings of the chief divinities would also contribute greatly to a comprehension of the text.

Archæological Explorations at Madisonville, Ohio.—The most thorough piece of archæological work with which we are acquainted at the present time, is the exploration of an ancient cemetery under the direction of the Literary and Scientific Society of Madisonville. The reports are prepared chiefly by Mr. C. F. Low, to whom we are indebted for copies. The explorations, begun in 1878, were first undertaken by Dr. Metz and others in order to save from loss and destruction the mound relics of the vicinity. While exploring a mound, a laborer, prospecting in the neighborhood, came upon a skeleton at a depth of two feet. Subsequent investigation revealed the fact that the entire plateau is the site of an ancient cemetery, from which have been exhumed upward of four hundred skeletons, accompanied by stone implements, pipes, pottery, charred matting and corn, tools and ornaments of bone, shell and copper. The reports are numbered I, II, III, and each succeeding one is a more careful report than the others of just what we desire to know. A detailed account of the whole exploration is in progress, and we shall not, therefore, speak querulously of the shortcomings of the present numbers. From the data before us we gather that there were two horizons of sepulture, the deep, averaging nearly four feet, and the shallow, averaging eighteen inches. Four-fifths of the bodies were interred in a horizontal position, not one-tenth in a sitting posture; and all the children were buried stretched out. As far as indicated, the orientation was as follows: North, .07; south, .43; east, .22; west, .02; north-east, .03; south-east, .17; south-west, .02; north-west, .04. This, of course, is to be considered only as a very rough estimate; but the great preponderance of cases where the head is towards the south or the east is very noticable.

The most remarkable feature of the cemetery, however, is the presence of ashpits in great profusion (over two hundred have been explored), very few of which contain any human remains. They are about five or six feet deep, and contain the following layers: On the top leaf-mold has drifted in, and filled the cavity occasioned by the settling to a depth of two feet, more or less. The remaining space is filled with layers of charred wood, ashes and animal remains, clay, sand, and even corn, both shelled and on the cob. The bones and implements are not burned, which refutes the theory that the pits were for cremation. Many beautiful objects have been recovered from these ash-pits, and among them a bone implement entirely new. Plates 1 and 2 present lithographs of these bone drawing-knives or leather-smoothers (?).

The Revue d'Anthropologie.—Number three of this standard review bears on its title page the mournful news of the death of Dr. Paul Broca, which occurred on the night of July 8th. A full account of his labors will be given in the next *fasciculus*. The reviews are really more entertaining and valuable than the original contributions, excepting that of M Lagneau; but a list is appended with the hope that some of our readers may find cause to differ:

Notice sur la découverte de squelettes humains dans le lehm de Bollviller (Haut-Rhin), by M. J. Delbos.

Description des ossements humains fossiles trouvés dans le lehm de Bollviller, by Dr. Réné Collignon.

De la place de l'anthropologie dans les sciences, *réponse* à M. Wyrouboff, by Dr. Dally.

Note sur la secte des Simos, au sud du Sénégal, by Dr. Berenger-Feraud.

De quelques dates reculées intéressant l'ethnologie de l'Europe centrale, by Dr. Gustave Lagneau.

Monuments préhistoriques du Berry, by Ludovic Martinet.

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Brackett, Anna C.—Indian and Negro. *Harper's Mag.*, Sept.

Brandreth, E. L.—The Gaurian compared with the Roman language. II. *J. Roy. As. Soc., Gr. Br. &c.*, July.

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Charnay, I. D.—The ruins of Central America. *N. A. Review*, Sept.

Clodd, E.—The later stone age in Europe. *Modern Rev.*, July.

Cloquet, Dr. N.—Etudes sur le préhistorique à l'Exposition universelle de Paris, 1878. Mons, 1880, pp. 64, 8vo.

Cox, G. W.—The migration of popular stories. (*Fraser's Mag.*) *Eclectic*, Sept.

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D'ACY, M. E., et M. ARCELIN—Lettre et réponse : La classification archéologique appliquée a l'époque quaternaire dans la Revue des questions historiques, p. 605–633, 4e année, 2e livr., Bruxelles, 1880.

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LEGGO, W.—Canada and her Indian tribes. *Canadian Month.*, Aug.

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McCURDY, J. F.—Relations of the Aryan and Semitic languages. *Bibliotheca Sacra*, July.

MACINTYRE, J.—Notes on the Corean language. *China Rev.*, Jan., Feb.

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NADAILLAC, M. DE—L'origine de la vie. Paris, 1880. pp. 32, 8vo. (Extr. du *Correspondant.*)

NEWMAN, F. W.—Notes on the Libyan languages. *J. Roy. As. Soc. Gr. Br. &c.*, July.

OPPERT, M.—La Méthode chronologique. *Rev. Historique*, July.

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ROCHEBRUNE, U. T. DE—Récherches d'Ethnographie botanique sur la flore des sépultures péruviennes d'Ancon. pp. 20, in 8vo. Bordeaux. (Extrait *des actes de la Société linnéenne.*)

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TURNER, PROF.—Two masks and a skull from islands near N. Guinea, Ill. *J. Anat. and Physiol.*, IV.

VALLENTIN, FLORIAN—Ancienneté de l'homme en Dauphiné et accessoirement en Provence et en Savoie. Grenoble, 1880. pp. 34, in 8vo.

WALHOUSE, M.—Rag bushes in the East. *Indian Antiquary*, June.

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GEOLOGY AND PALÆONTOLOGY.

THE VERTEBRATA OF THE EOCENE OF THE WIND RIVER BASIN.—The current number of the Bulletin of the U. S. Geological Survey of the Territories, contains a synopsis of the extinct species above referred to. They number forty-five, and of these twenty-six are new to science. The species are distributed as follows: Fishes—*Clastes*, 1 sp.; *Pappichthys*, 1 sp. Reptiles—*Lacertilia*, 2 sp.; *Testudinata*, 2 sp.; *Crocodilia*, 1 sp. Mammals—*Chiroptera*, 1 sp.; *Rodentia*, 3 sp.; *Tæniodonta*, 1; *Insectivora*, 2; *Creodonta*, 9; *Mesodonta*, 9; *Amblypoda (Pantodonta)*, 2; *(Dinocerata)*, 1; *Perissodactyla*, 8; *? Artiodactyla*, 3. The new species are distributed as follows, all being *Mammalia: Chiroptera*, 1; *Tæniodonta* 1; *Insectivora* 2; *Creodonta* 8; *Mesodonta* 4; *Amblypoda*, 1; *Perissodactyla* 7; *? Artiodactyla* 2.

The facies of the fauna is that of the Wasatch rather than that of the Bridger epoch, but it contains, nevertheless, several genera hitherto regarded as characteristic of the Bridger; such are *Pappichthys* and *Palæosyops*. The sub-order *Dinocerata* has not previously been found associated with *Coryphodon*. The sole representative of this division belongs to a new genus, and is named *Bathyopsis fissidens*, by Prof. Cope. The genus is defined as follows: Dental formula, I. 3; C. 1; Prem. 4; M. 3,—in the lower jaw. First premolar in the series with the incisors and canine, and followed by a diastema. The entire inferior border of the lower jaw expanded downwards into a plate with convex inferior border, thus differing from *Uintatherium (Dinoceras)*, where the jaw is flared downwards in front only, and *Loxolophodon*, where there is little or no inferior expansion. There is a chamber-like enlargement of the dental canal, and a large mental foramen. The *B. fissidens* is about the size of the Malayan tapir. The anterior inner cusps of the inferior molars are double, and there is an oblique ridge commencing on the external border of the heel of the molars, and extending inwards and forwards.

Prof. Kerr on Frost Drift.—Prof. W. C. Kerr, State Geologist of North Carolina, read an interesting paper, February, 1880, before the American Institute of Mining Engineers, on what he calls *frost drift*, with especial reference to the gold deposits of his State. He finds a thick layer, sometimes amounting to a depth of one hundred feet, covering rocks in various parts of the State, which is evidently derived from their decomposition, and which has remained nearly in situ. He has observed, however, that the materials of these strata are frequently sorted, the larger undecomposed fragments lying near the bottom of the mass, hence it is evident that they have been moved, and without regard to the direction of the inclination of the surface. He thinks that this rearrangement has been produced by the alternate freezing and thawing of the bed. The gold of the placers has, in this way, gradually found its way to the bed-rock or slate, where it is now found by the miners. Placer mining has been practiced for many years in North Carolina, and the methods now in use in California, were carried there by emigrants from the former State.

Discoveries of Minerals in Western North Carolina.—

During the month of May, 1877, while on a buggy trip from Statesville to Hickory, I discovered from my buggy a deposit of drift gravel along the roadside a few miles east of the town of Hickory, which promised something handsome in the line of quartz crystals. I started out on the 4th day of the following June (1877) to trace out the indications offered by that pile of gravel scattered promiscuously along the roadside. By actual measurement, the belt of drift deposit extending a long distance with a north-east and south-west trend, was three-quarters of a mile in breadth. My first diggings were on the lands of Mr. E. Bolch, and, under my personal supervision, soon reached a pocket of water-bearing smoky quartz crystals at a depth of two feet under ground. Here I found my first basal plane on quartz crystals (smoky and clay-tessellated). Devoting my entire time to field work in the drift belt of this neighborhood, I examined nearly fifty different localities found either by myself or by workmen trained under my personal teaching. The result by the 1st of January, 1878, was the discovery of thirty-five new localities for the following list of minerals, together with a determination by myself of the separate species:

Water-bearing crystals of quartz; Carbon dioxide-bearing crystals of quartz; Smoky quartz crystals; Amethyst quartz crystals; Quartz crystals enclosing layers of red clay; Quartz crystals enclosing coloring matter of various hues; Quartz crystals enclosing other crystals; Quartz crystals enclosing small prisms of mica; Quartz crystals enclosing pyrites; Quartz crystals enclosing rutile. (The most magnificent specimen of which (7x4 in.) enclosing three beautiful rosettes of rutile, I presented to my friend Mr. Wilcox, of Philadelphia.)

Having seen in the cabinets of my friend Stephenson, of Statesville, a number of so-called seventh planes on the *prisms* of quartz crystals which he obtained in Alexander county, I went diligently to work for such localities in Catawba county. My search, at first, was fruitless, but I observed a singular feature in some of the crystals dug from this first pocket I had discovered in this county. This feature consisted of a well marked plane parallel to the lateral axis, or a plane truncating the *pyramid* at a right angle to the prism. This I claim is the first American locality for quartz crystals with basal planes; the locality itself, as also the observation of the peculiar planes, being my own original discoveries. I delayed the publication of my secret through fear of attracting attention to the locality. This was in June, 1877. In July and September following I had discovered fifteen new localities in the vicinity for water-bearing quartz crystals, obtaining as many as 550 specimens. During the same months I obtained nearly seventy crystals with the basal planes. My work continued through the months of October and November, when the winter caused a suspension of field labors.

In the month of March, 1878, my field explorations were renewed, and with almost continuous work, extending through the months of April, May, June, July, August, September and

October of the same year. I discovered and worked on fifty-six different new localities yielding the same species before mentioned, with the addition of

Black Tourmaline; Brown Tourmaline; Green Beryl; Melanite (garnets) in Muscovite; Sagenite (meshed rutile); Acicular rutile; Rutile in amethyst. (This last named species I also claim as having first discovered in this country, if not in the world.)

The result then of my field work in Catawba county, N. C., from the 4th day of June, 1877, to the 1st day of November, was the discovery of ninety-one new localities for minerals and the scientific determination of the following list of species obtained from these localities new to science:

Quartz crystals, drusy; do, reniform; do, botryoidal; do, asteriated; do, acicular; do, aventurine; do, filiform; do, reticulated; do, water-bearing; do, carbon dioxide-bearing; do, enclosing layers of red clay; do, enclosing coloring matter of various hues; do, enclosing other crystals; do, enclosing (microlites after Vogelsang); do, enclosing pyrites; do, enclosing small prisms of mica; do, enclosing rutile; do, (amethyst) enclosing acicular rutile; do, (amethyst) enclosing sagenite rutile.

Many of these were twins, geniculations, double terminals and in groups—varying in colors from black (of various shades) to the most pellucid variety, including green, yellow (citrine) smoky, purple, milky and almost every tint known to chemistry.

Crystallographically I have discovered in these new localities the following list of forms:

Basal planes.	Trigonal prisms.
Hexagonal pyramids.	Rhombohedrals.
Dihexagonal "	Trapezohedrals.
Trigonal "	And hemimorphic forms.

The weight of these separate crystals runs from one grain to one hundred pounds.

There are two very singular groupings among these crystals; the one being a number of amethyst crystals grouped upon a group of milky crystals, the other (resembling Fig. 335, p. 101, in E. S. Dana's Text Book of Mineralogy, Ed. 1877) being a series of quartz crystals all in a parallel position on the prism and pyramid faces of a group of acicular milky quartz crystals.

I believe I have discovered in this belt more than two-thirds of the forms of quartz known to science. This, however, I will determine before the year closes.

On a group of thirteen smoky crystals, having unitedly fifty-two easily discernible and movable bubbles, and nine different basal planes, there is one crystal with a basal plane and a cavity enclosing a gas, a liquid and a solid—the finest and most interesting specimen of its class which has ever been discovered.

In the months of July and August of 1878 I discovered two new localities, in Burke county, for basal planes on quartz, three new localities for sagenite and the golden colored rutile, two new localities for liquid-bearing crystals, one new locality for corundum crystals with a border of fibrolite and enclosed in micaceous schist, one new locality for tourmaline, one new locality for aqua marine, and in conjunction with Mr. W. E. Hidden, I discovered forty-one different minerals in a few ounces of Brindletown gold sands, being by far the largest and rarest number ever obtained at one time by an examination of these celebrated sands:

Titanium.	Zircon.
Titanite.	Thorium.
Menaccanite vel Ilmenite.	Graphite.
Rutile.	Corundum (white).
Anatase vel Octahedrite.	" (blue).
Octahedrite.	" (red).
Ilmenite.	" (gray).
Brookite.	" (yellow).
Iron.	Feldspar.
Limonite.	Albite.
Mag. Iron.	Actinolite.
Granite.	Tourmaline.
Gneiss.	Schorl.
Itacolumite.	Epidote.
Quartz.	Beryl.
Garnet.	Tremolite.
Schist.	Hornblende.
Monazite.	Soapstone.
Amethyst.	Kyanite.
Gold.	Cairngorm Stone.

This paper, in conclusion, is merely to place on record the results of my three years' field work amongst the minerals of North Carolina, until I can elaborate them (with engravings) in a substantial book form.—*John T. Humphreys, Greensboro, N.C.*

Geological News.—Prof. Hitchcock is preparing a new geological map of the United States.——Prof. Hall has identified the Oneonta and Montrose sandstones, and finds them to form a fresh-water deposit below the Chemung.——Prof. Collett has found a remarkable deposit of extinct Unionidæ in Vandenburg county, Ia.——Prof. Leidy has determined a number of species of Vertebrata from bones found in a cave in Northampton county, Pa. All of the species are existing excepting two, a *Castoroides* and a Peccary. —— Mojsisovics and Neumayr are publishing an extensive work, Beiträge zur Palaeontologie von Oesterreich-Ungarn. The two first monographs have appeared; they are Lugmayer on Rhætic *Brachiopoda*, and Bittner on Early Tertiary *Echinida* of the Southern Alps.

GEOGRAPHY AND TRAVELS.[1]

The Explorations of Capello and Ivens in West Central Africa.—In previous numbers of the Naturalist some accounts have been given of the expedition fitted out early in 1877, by the Government of Portugal and the Lisbon Geographical Society for the exploration of western and southern Central Africa. The party was under the command of Major Serpa Pinto, and started

[1] Edited by Ellis H. Yarnall, Philadelphia.

from Benguela on the west coast, proceeding by a southern route, touching the fifteenth parallel of south latitude, entering the mountainous region of Dombé, and passing to the east of Quillengues, finally reached Bihé in March, 1878. Here Major Serpa Pinto left his companions and started on his perilous journey along the upper waters of the Quando and Zambesi, and thence southward through the Transvaal and Natal to the east coast.[1]

Captain B. Capello and Lieutenant R. Ivens left Bihé in May, pursuing a north-easterly direction, crossing the Quanza, whose source is the Mussombo lake in S. lat. 13° 30′, E. long. 17°, and after long marches through an overflowed country, on June 24th arrived at the Luando, an important tributary of the Quanza. To the north of this stream are the tribes of the Songos and Quiocos, while the Ganguellas, a strong powerful race of men who carry on an active trade with Bihé, occupy the country to the south. At the distance of two hundred and fifty miles from Bihé the forest district of Quioco was reached, one of the most interesting of Central Africa in its hydrographical character. From here the expedition followed the Quango river, Capello taking the east, and Ivens the west side of the stream. Both found the country very difficult to penetrate owing to the overflowing of the river, and its many tributaries, the density of the vegetation and the broken irregular character of the surface. The explorers met finally at Cassange, and made several excursions east and north from that point. Proceeding from there to Malange, and turning north, they followed the eastern slope of the Tala-Mogongo range, crossing many streams flowing into the Hamba, an important affluent of the Quango to the forest country of Hungo. Marching on they discovered a great number of streams and countless small lakes. MM. Capello and Ivens believe that these should take the place of the large lake, Aquilonda, found on many maps at this point (7° S. 17° E.), and which they state does not exist. After arriving at a small village called Malundo, about 7° 30′ S. and 16° 30′ E. they were obliged to retrace their steps owing to the exhaustion of their stores, illness, and the difficulties of the country.

To the east of the Quango here is the country of Jaca, one of the most important of the African interior, which extends as far as the Congo and was entirely unknown previously. The return was made to the Portuguese settlement of Duque de Braganza on the Lucalla, and through a fruitful, healthy country to the Quanza, the course of which river they followed down to the sea. They reached Portugal in January last, and this account is taken from papers read by them before the Lisbon Geographical Society, and the Geographical Section of the British Association. A beautiful detailed map in MS. of the country explored was exhibited at the

[1] NATURALIST, September, 1879, p. 593.

latter. The route is roughly shown in a "Provisorische Karte," published in *Petermann's Mittheilungen* for September, 1880.

The total length of the land journey thus accomplished was 4214 kilometers.

As to general configuration, the whole region of West Africa covered by the expedition south of the equator may be described as consisting of three well-marked areas: I. A central table-land where the richness of the soil and the regularity of the rain-fall cause a luxurious and varied vegetation; II. A hilly region surrounding the table-land and forming a water-shed dividing the waters of the Quanza, Cunene, Cubango and other large rivers, and possessing a less luxuriant but abundant flora, and a variety of fruits and vegetables; III. A zone of lowland near the coast barren and unhealthy from the many swamps.

Between Benguela and Bihé innumerable streams were crossed, almost all of them having their sources in the elevated central regions, and reaching the coast by successive rapid descents between the 9th and 17th parallels of latitude. Among the most remarkable is the Copororo (the left bank of which was followed by the expedition), the Cunene, and the Cubango (the course of which, by exception, is towards the south-east). All these rivers are extremely tortuous and full of rocks, and their currents being rapid, they seem in general to be little adapted for any kind of navigation.

Another peculiarity of the river systems is the tendency of the innumerable affluents on each side to flood their banks, thus rendering their survey extremely difficult. All take their rise on the northern or southern slopes of the great central ridge which traverses the interior in the latitude of Quioco, south of Bihé, and is prolonged south of Lake Bangweolo under the name of Muchinga, to the plateau of Lobisa. This is the most important elevation of Central Africa south of the equator, as it forms the dividing point between the basins of the Congo and the Zambesi, in conjunction with another elevated ridge called Mossambé, running north and south, and intersecting it in 12° S. lat., and 18° E. long., on which are the sources of innumerable affluents of the Zambesi and the Congo.

On account of this intersection taking place near it, the region of Quioco must be considered as of high interest to the scientific geographer, and well deserving of the epithet of "Mother of Waters" in south-west Central Africa. In the space of 1000 square miles around the residence of a chief named Mune Quibau the expedition discovered, at distances not more than twenty miles apart, the source of five or six of the most important rivers of the continent, viz: the Quango, the Kassai, the Luando, the Chicopa, the Lume, and the Jombo, besides about a hundred smaller streams, tributaries of the preceding.

The Quango at first flows between the two great mountain ranges of Tala-Mogongo (on the west) and Moenga (on the east) forming many cataracts and rapids, and receiving many affluents, all of which were surveyed. The most important falls are six in number, the last being situated in 8° S. lat. Many of the affluents were previously unknown. In the 7th parallel of south latitude, the mountain range of Tala-Mogongo cuts obliquely another system of sierras, named in the north, Zombo, which extends to the Congo above the Yellala falls. The extensive region of small lakes before mentioned is situated on the slopes of this latter mountain range, and the expedition charted various rivers having their origin in the range as also all the numerous streams of the western slope in the Luamba region. With regard to the natives—all belonging to the great Bantu division of the Ethiopian race—the general observation may be made that the physical, mental and social development of the very varied tribes improves in the ratio of the altitude of the locality. The greater the altitude of his home the more perfect is the native, and the natives of the coast region are the most rachitic, the least intelligent and the most unfortunate of all. In the industrial arts it is also remarkable that the tribes farthest in the interior, and therefore most remote from European contact, are the most ingenious. The coast native does not manufacture a knife for his own use, the inhabitant of the plateau does; the latter even manufactures hoes, and sells them to the degraded coast negro. The difference is enormous between the Ganguella and the Maiaca, the one living at an altitude of 5500 feet, in a climate of 64° mean temperature, and the other at an altitude of 1600 feet, in a mean temperature of 80°.

The political system is very similar in all the tribes. Each has a chief who at times transmits his power to his successors in a collateral line, while at other times a chief is elected by the people. Polygamy is characteristic of the lowest tribes; fetishism and the most brutal superstition and slavery everywhere prevail.

The expedition collected material throughout their journey towards vocabularies of the many native languages. Being furnished with a very complete outfit of scientific instruments, they have been able to bring home an extensive series of observations in magnetism and meteorology as well as in all appertaining to their special work, the fixing of positions by astronomical and hypsometrical observations, and the geographical survey of the regions traversed.

COL. PREJEVALSKY.—Further accounts received from Col. Prejevalsky informs us, that in May last he was at Houi-dé on the Hoang-ho. He left Sining on March 20th, and explored the Yellow river for one hundred miles or more, but was unable to proceed further or ascertain the sources of this great river. At Gomi, where the river is 8000 feet above the sea-level, it is from 420 to 490 feet wide. Above this place their "progress was frequently arrested by deep ravines, which seam the banks, and suddenly disclose their precipitous and dismal depths, the more unexpectedly as the plain over which one happens to be marching appears to be perfectly level. A river usually flows at the bottom of these enormous crevasses bordered with trees and shrubs. Footpaths lead into many of them, but the descent is most difficult, especially for mules and pack-camels."

On reaching the mouth of the Churmysh, and reconnoitering the country for a distance of nearly thirty miles, Prejevalsky "became convinced of the impossibility of crossing the enormous mountain-chain extending along the Yellow river. The summits of these mountains are lost in clouds, gloomy ravines are encountered at every verst, and there is not the slightest trace of vegetation, therefore no forage for our animals. Pursuing my investigations further, I saw clearly that our mules could never go round these mountains, the roads being only accessible for camels accustomed to the privations of the desert, and it is even doubtful if camels could accomplish the ascent of the Burkan-Buddha." He therefore turned back down the stream to Houi-dé, forty miles below Gomi, arriving there two months after his departure from Sining.

Five hundred specimens of birds and many fishes and plants have been collected. "Blue pheasants were particularly numerous. This fine bird, only a few specimens of which may be seen in the Museums of Paris, St. Petersburg, and London is met with frequently at an altitude of 9500 feet. Every day we killed several, and preserved twenty-six for our collections. Had it not been for difficulty of transport, we might have collected hundreds. The second rarity of this country is rhubarb, often found in large quantities. Old roots of it grow to a colossal size. One of those I took measured sixteen inches in length, twelve in breadth, and seven in thickness, and weighed twenty-six pounds."

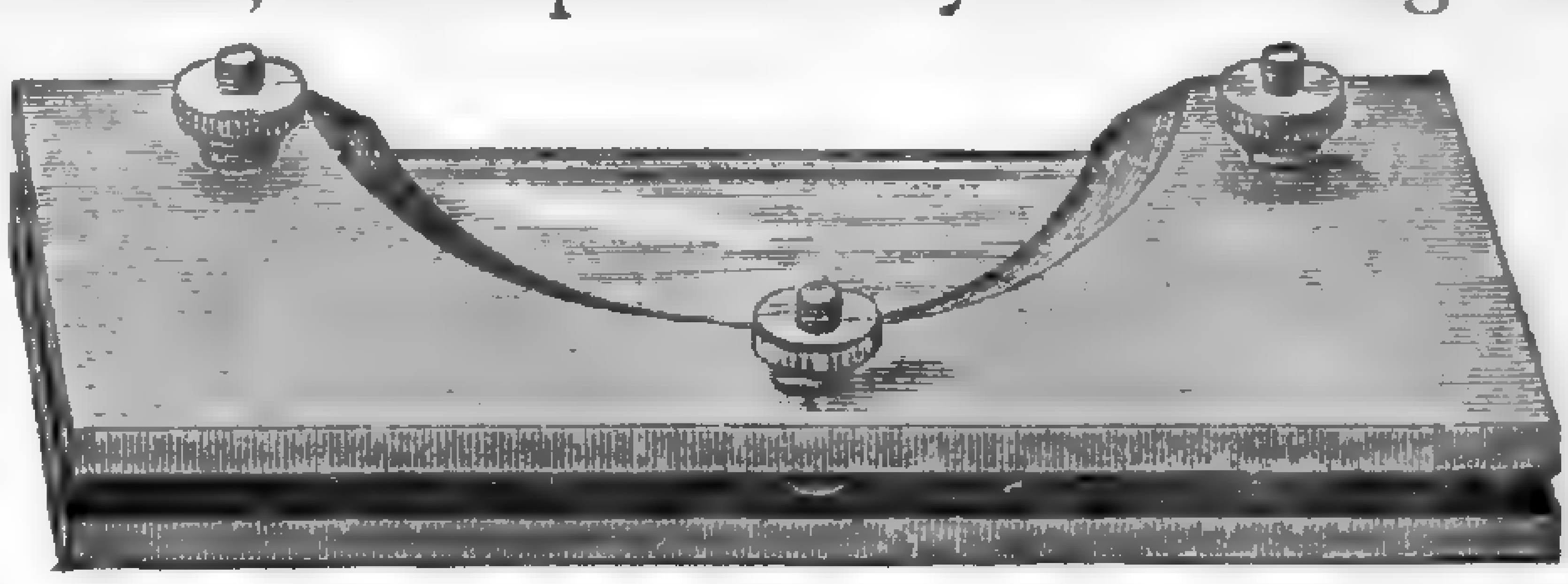
MICROSCOPY.[1]

ADULTERATIONS OF DRUGS.—A report on this subject by C. Lewis Diehl, in the National Board of Health Bulletin, states that most of the information that can be gained on the subject is too vague or general in its character to be satisfactory. It is understood that the falsification of drugs is carried on extensively at the present time, and it is known that certain drugs are particularly subject to adulteration or falsification, but there is great difficulty in obtaining particulars that are definite or valuable. The literature of the subject, except a few papers of general scope, is mostly included in the standard text books of pharmacy, and in the Proceedings of the American Pharmaceutical Association, which have been published annually since 1852. The author discriminates carefully between deteriorations which may take place

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

by time or by improper exposure to causes of change, and substitutions which may be made unintentionally or without the knowledge of the vender, and adulterations which imply intentional debasement for the purposes of deception and gain. The general conclusion is reached that the drug market is so fairly honest that persons who really desire to obtain articles of standard quality, and at a proportionate price, have very little difficulty in being able to do so, and can be suited by respectable dealers throughout the land, while poor and adulterated articles are present, and are very likely to be obtained by ignorant persons or by those who are indifferent to the character of the dealer, and are desirous of regulating their purchases by the price rather than the quality of the goods. Crude drugs can usually be obtained of good quality, though many are sold, which have deteriorated by prolonged or careless preservation. Powdered drugs (those of fair quality can usually be obtained) are liable to the grossest adulterations, particularly those which are frequently handled (like spices) by both grocers and druggists. That this practice still continues is shown by the fact that powders are often sold at the price of, or at an inadequate advance upon, the crude drug, notwithstanding the loss incurred in drying and powdering. Infusions, decoctions, solid and fluid extracts, and tinctures are all found to vary in strength and quality from good and indifferent to positively bad; some manufacturers adhering to the requirements of the Pharmacopœia, while others admit inferiorities in order to save cost and to be able to undersell.

HARD RUBBER ZOOPHYTE TROUGH.—A new zoophyte trough, just brought to notice, is so neat, convenient, and free from faults that it cannot fail to be used with pleasure. Two plates of glass, somewhat like glass object slides, are separated by a half ring of soft rubber, and clamped together by two plates of hard rubber, held together by binding screws, and cut away to show the objects, as illustrated in the engraving.



These troughs contain many valuable features; any thickness of glass can be used, and it can be easily taken out for cleaning, and easily replaced if broken, and the thickness of the cell can be varied indefinitely by using different thicknesses of sheet rubber between the glasses. The whole contrivance is an adaptation, in a most attractive and valuable form, of the troughs which have been used for holding living objects, and for exhibiting crystallization, in the projecting microscope. It can be obtained from Mr. Walmsley, manager for R. & J. Beck, 1016 Chestnut Street, Philadelphia.

THE ACME MICROSCOPES.—John W. Sidle & Co., of Lancaster, Pa., have issued a catalogue which gives a fair representation of their new enterprise. Besides the very simple and excellent Acme microscopes and the accessories belonging to them, much information is given in regard to microscopical supplies in general.

THE SPENCER OBJECTIVES.—The partnership heretofore existing between C. A. Spencer & Sons, has been dissolved, and Herbert R. Spencer announces that he will hereafter furnish lenses marked H. R. Spencer & Co., made after the same formulas, and of the same uniform excellence, which have for years past characterized the lenses made under his supervision, by the old company.

GUTTA PERCHA CELLS.—These rings for mounting dry objects, can be obtained from Lloyd H. Smith, of Geneva, N. Y., at from fifty to eighty cents per hundred. They are such as are used by Prof. H. L. Smith, and are suitable for diatoms and other thin objects.

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SCIENTIFIC NEWS.

— The U. S. Entomological Commission designs preparing for publication, probably in the appendix of its third report, a bibliography of American (and Canadian) economic entomology. The bibliography will contain references to papers, articles and notes in agricultural and popular scientific periodicals, as well as journals devoted to bee culture, and as complete as possible references will be made to entomological notes in those periodicals which appeared prior to 1850. The titles of notes, articles, reports on works, will be entered under the name of authors, or of periodicals, especially agricultural reports and papers, with brief digest of contents given in a line or two, in the same style as in Mr. Mann's excellent bibliographical record of *Psyche*, the organ of the Cambridge Entomological Club, of Cambridge, Mass.

After due pains are taken such a record will necessarily be quite imperfect. The compiler will have to rely much on aid from authors of any and every article or note on economic entomology. Its completeness will greatly depend on the care with which entomologists may prepare lists of their own articles. Entomologists are therefore earnestly requested to coöperate by sending full lists of their papers or notes on any subject connected with *economic entomology* (not general or scientific entomology unless bearing on the applied science) and prepared in the style of that of *Psyche*, to A. S. Packard, Jr., at Providence, R. I.

— Jacob Boll, of Dallas, Texas, died recently in Western Texas at a distance from civilization. He was a native of the Canton of Aargau, Switzerland, and was a pupil of Agassiz before the latter came to the United States. He was active in promoting educational reform in his native country, and was an authority in entomology. During a long residence in Texas he was an untiring collector, and sent many specimens to Europe. His collections of insects, especially of Lepidoptera, are unequaled for beauty. He was a good geologist, and contributed articles to various journals, including the AMERICAN NATURALIST. For two years previous to his death he was engaged in explorations, for Prof. Cope, in the Permian region of Texas. He discovered numerous remarkable extinct vertebrates, which have formed the subject of various papers. These number thirty-two species, and they have thrown great light on the nature of vertebrate life at that early period. Mr. Boll was a most amiable man, and his death is a serious loss to science.

— The report of the committee on science teaching in schools, read by Dr. Youmans before the American Association, arraigns the unscientific methods by which science is usually mistaught in schools. He justly claims that science, as a means of training the faculties in the various ways to which they are severally adapted, is not taught in the public schools. It is not made the means of cultivating the observing powers, or of stimulating inquiry, or of exercising the judgment in weighing evidence, or of forming original and independent habits of thought. Wide personal differences of capacity, aptitude, attainment and opportunity not only exist among children, but they are the prime data of all efficient mental cultivation. In the graded schools, just in proportion to the perfection of the mechanical arrangements, individuality disappears; and with individuality goes originality. Science, if rightly pursued, is the most valuable school of self-instruction. From the beginning men of science have been self-dependent and self-reliant, because self-taught.

— Mr. Alfred R. Wallace has published, says the *Academy*, a new work entitled "Island Life," which deals with the problems presented by insular faunas and floras by the aid of the most recent geological and physical researches. A special feature in the work is the importance attached to former changes of climate, as indicated by glacial phenomena and the luxuriant floras of polar regions; these are carefully investigated, and a somewhat novel solution of the whole problem of geological climates is given.

— The third annual book of the Michigan Sportsmen's Association contains some excellent reading matter. The report on nomenclature, barring some inaccuracies, is an excellent one, and most timely, as is Mr. Fred. Mather's and Mr. J. G. Portman's papers on fish propagation and protection. Such associations and publications as these, will tend greatly to increase the interest of the public in economic zoölogy and all that pertains to it.

— The conch fisheries of the Bahamas, according to the *Scientific American*, are of considerable importance, many tons being exported to Italy, France and Germany from Nassau; in Italy they are cut into sleeve buttons and brooches, and in France and Germany they are used in porcelain manufactories. $50,000 worth of conch pearls are annually exported from Nassau.

New York Academy of Sciences, Nov. 8.—Prof. Newberry made a communication on the antimony mines of Southern Utah. Prof. D. S. Martin exhibited specimens of wax from the Carnauba palm of Northern Brazil, and gave an account of its production, etc.

Nov. 22.—Miss Adelina Bierck described the volcanic eruption at Lake Ilopango, San Salvador, and Mr. A. A. Julien gave an account of a visit to the great alum cave of Sevier county, Tennessee.

Nov. 29.—Prof. H. A. Ward gave a description of the Island of Volcano.

American Geographical Society. Nov. 18.—Rev. Owen Street read a paper on the changes in the physical geography of the ancient home of man in Central and Western Asia.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

Zeitschrift für Wissenschaftliche Zoologie—Nov. 6. On the relationship of the Cephalopoda, by H. von Ihering. The organ of smell of the land pulmonates, by Dr. D. Sochaczewer. (Refers to the structure of the feelers, and Moquis Tandon's opinion that the end or "terminal button" is the seat of the organ of smell. He then discusses the nature of the organ of Semper and of the foot-glands, and thinks that the latter are more properly organs of smell, as at the base of the excretory duct of the pedal gland are distinct ciliated sense-cells which are like the ciliated sense-cells in the skin of mollusks discovered by Flemming.) On the cases of the Trichopterous larvæ of Santa Catharina, Brazil, by Fritz Müller. (Figures and describes a great variety of singular forms of caddis-fly cases.) Researches on the Dysideidan and Phorio-sponges, by W. Marshall. On two early human embryos, by W. Krause (with excellent figures). The pedal nerve-system of *Paludina vivipara*, by H. Simroth.

The Geological Magazine—November. Precambrian volcanos and glaciers, by H. Hicks. The Mammoth in Siberia, by H. H. Howorth.

Dates of Publication of the Naturalist for 1879 and 1880.—1879: January No., January 4th; February, February 4th; March, February 27th; April, March 26th; June, May 20th; July, June 17th; September, August 22d; November, October 25th; December, December 4th. 1880: January, January 2d; February, January 31st; March, February 25th; April, March 21st; May, April 27th; June, May 21st; July, June 18th; August, July 22d; October, September 21st; November, October 23d; December, November 25th.

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INCOMPLETE ADAPTATION AS ILLUSTRATED BY THE HISTORY OF SEX IN PLANTS.[1]

BY LESTER F. WARD, A.M.

THE doctrine of abrupt changes or cataclysms in nature has a remarkable survival in the still prevalent belief in perfect adaptation. As it was formerly held that organisms were purposely made for their conditions and exactly adjusted to them, so now, since the law of self-adjustment has become current, it is supposed that the organism and the environment have in all cases reached a condition of complete correspondence. It is in virtue of this assumption that the law of cross-fertilization of plants has been called in question, and an eminent botanist once remarked to me that the slight difference between the results of Darwin's experiments under cross and under self-fertilization, amounting on an average to one-fifth of the whole, was sufficient to invalidate that law.

Nothing seems so difficult for the human mind to grasp as change through minute variations indefinitely continued. Even those who admit that this is nature's method, fail to realize it in concrete examples.

We may suppose that a given character not possessed by a given species would, as a matter of fact, be an advantage to such species if it could acquire it. We may further suppose that for any reason the species commences to vary in the direction of acquiring that character. The benefit will be proportional to the degree of completeness with which the character is attained.

[1] Read before the Biological Section of the American Association for the Advancement of Science, at Boston, August 27, 1880.

Under the law of natural selection, the perfection of the character will ultimately be reached, but a very long period, to say the least, must elapse during which it is still incomplete.

Again, the conditions surrounding a species are constantly changing, usually slowly, but sometimes rapidly or suddenly. In this way the usefulness of certain characters is frequently destroyed, but the species cannot lose the character; it persists and gradually becomes atrophied or transformed into a different one. Such changes in organisms are very slow, and vast periods are passed through before they are completed.

Now, considering the changes going on at all times in the conditions under which species exist, it may often happen that the period during which adaptation is incomplete from both these causes, is greater than that during which it is complete. Indeed, as a matter of fact, the adaptation is never absolutely complete, the organism being always, as it were, behind its environment, as the tides are behind the moon.

If this be true, we ought to expect constantly to find examples of incomplete adaptation. A character which required to be complete before it could be advantageous could never be acquired by natural selection. All such characters as are acquired must be advantageous in proportion as they are complete.

Naturalists must therefore learn to regard a large proportion of the characters which they find to exist, as partial or uncompleted characters, useful to the species in proportion as they are developed, but capable of greater adaptation.

There are, moreover, two general classes of characters with respect to their usefulness and advantageousness to the species. Those of one of these classes are only useful to a certain limited degree, beyond which they may be injurious, and which only apply to particular species in their relations to definite existing conditions. Such characters may be called *special.*

The other class, which may be distinguished as *general,* apply to all organisms, and are less limited in their degrees of possible development.

Passing over the class of special characters, I propose to illustrate the principles above stated, by an example in the class of general characters taken from the vegetable kingdom.

The distinction of sex is a condition advantageous to all plants, and one in the process of attaining which a large number of gradations are to be found. The purely asexual state exists only in the lowest Protophytes, as in Saccharomyces, the Phycochromaceæ, and other unicellular forms. The simple phenomenon of conjugation or copulation seen in the Zygomycetæ and diatoms, forms the earliest step towards sexual differentiation, which is followed by the various intermediate steps represented by the pairing of active cells in Volvox, the formation of oöspores in the Confervæ and Fucaceæ, and of carpospores in the Fungi.

In the Characeæ we first find the well marked distinction of antheridia and carpogonia, the former furnishing in Nitella the active spermatozoöids which differ immensely from the cells with which they combine. This latter feature continues to characterize all the higher Cryptogams, though in nearly all cases the organs of both sexes are borne on the same plant. The transition from the Cryptogams to the Phanerogams is effected by a primary differentiation of the spores, which in most Cryptogams are the independent asexual bodies that produce the sexually differentiated prothallium. This prothallium loses its independence and becomes the albumen of the seed; the male spores are converted into pollen grains and the antheridia into the fertilizing pollen-tubes; the female spores are transformed into embryo-sacs containing corpuscles within which are the ultimate germ-cells.

In a certain sense this transition, instead of marking an advance in the process of sexual separation, constitutes a step backward, since the prothallia of Cryptogams, considered as distinct individuals, are respectively male and female, while the stamens and pistils of the Cycadaceæ and Coniferæ, the earliest Phænogams developed, though quite distinct in themselves, are both borne on the same plant. But the prothallium marks the highest development reached or possible to the Cryptogam. The Phænogam must begin from a point lower down, and in turn evolve sexually differentiated forms. The distinction of macrospores and microspores found only in the Rhizocarpeæ and Ligulatæ, and which, as already stated, initiated the transition from the Cryptogams to the Phænogams, took place in the same individual, both kinds of spores often occurring in the same sporangium, as in Salvinia. This, when the two kinds of spores at length came to represent the two sexual organs of the Cycad or the Conifer, necessarily reunited the sexes once more in the same plant, and the process of separation, so well completed in the higher Cryptogams, was required to be begun anew on the higher Phænogamic plane of development.

From this point, however, the history of this process is of the highest interest. In the Cycadaceæ complete diœcism was reached before any of the few now existing forms were developed, and all present living species are male and female. In the Coniferæ, different families have attained to different degrees of diclinism. The Taxineæ, which many facts show to have been among the earliest forms developed, are diœcious, while the great pine and fir tribes, as well as most cedars, are still monœcious. Both these great orders have come down to us from the Carboniferous epoch, and indicate, along with the remnant which we possess of the then luxuriant cryptogamic flora, the kind of vegetation which prevailed in those remote ages. The flowers even of the highest forms were uniformly inconspicuous and odorless. The only possible substitute for sexual separation was the distribution of pollen by the winds. Forms so high in development, it would seem, could not continue to exist through self-fertilization alone, and hence, under the operation of natural selection, more or less complete sexual separation early took place.

The transition from the Gymnosperm to the Angiosperm is veiled in great obscurity. Certain considerations point to the gradual transformation of the Cycadaceæ into the Monocotylæ through the Palmaceæ or some allied family, on the one hand, and to that of the Coniferæ into the Dicotylæ through the Gnetaceæ and Casuarineæ, on the other. However this may be, the earliest known fossil species of Angiosperms, dating back to the early Trias, consist of poplars, beech, oak, chestnut, sycamore, and other unisexual and diœcious trees, all of which want the showy flowers characteristic of the present flora of the globe.

In view of the fact that this early flora was to so great an extent diclinous, it becomes an important question why so large a proportion of the present flora is hermaphrodite. We find that many of the plants of the most recent geological development possess the means of self-fertilization within the same flower and no obvious means of crossing individuals. Upon closer observation, however, we perceive that many of these apparently perfect flowers possess arrangements of a more or less anomalous kind, which, inexplicable on any other theory, are all explainable as contrivances for the prevention of self-fertilization. The completeness with which this object is accomplished is of all degrees, from Epilobium with its style merely turned to one side, to Iris with its short extrorse anthers hidden away under the broad styles stigmatic on the inaccessible side; from mere heterostyly to complete dichogamy.

I need not review the conclusive reasoning by which all these morphological modifications are accounted for as the results of the long continued agency of insects. It is important only to point out that this influence has been powerful enough to reverse the entire course of sexual differentiation, which, as we have seen, has been in all lower forms constantly in the direction of a more and more complete separation of the sexes. It may be said that this proves too much, since progress in that advantageous direction once gained would not be likely to be lost. The sufficient reply to this is that, independently of the natural tendency to revert to the normal or monosexual state, when the separative influences are withdrawn, the reserve power of possible self-fertilization when for any cause cross-fertilization fails, as it clearly often may, is a positive advantage, and one which, under the proper circumstances, natural selection will insure.

The most significant fact which palæontology reveals is that of the simultaneous appearance of an insect fauna and a hermaphrodite flora. When the insects came upon the scene they found only a diclinous flora with usually apetalous flowers destitute of both fragrance and color. The succeeding strata immediately commence to exhibit plants of the rose, mallow, magnolia, pulse, and crowfoot families with showy petals, often fragrant, and provided with special nectaries for the secretion of honey. Most of these had already made their appearance in the chalk formation, while during the Tertiary the still more perfectly organized Gamopetalæ were developed. The agency of insects in the fertilization of plants and even in the transformation of flowers to adapt them to their uses is no longer questioned by any at all familiar with the facts, but wide differences of opinion exist with regard to the degree of this influence, and also to the meaning of particular facts. Much of this confusion is due to the prevalence of the notion to which attention was called at the outset, that all adaptation must be regarded as completed at the present time. This assumption of a statical condition in nature now, while admitting the necessity of a dynamical condition in the past, is wholly gratuitous and belongs, as already remarked, to the same class of ideas as that by which all changes were once explained as the results of great and sudden catastrophes. It is due to the kind of reasoning which denies change to everything which can not be seen to move—a kind of reasoning which leads the savage to deny that the great trees have ever been other than they are,[1] while admitting growth in the herb and the sapling. In point of fact we find nearly all possible degrees of adaptation to the agency of insects. The mere existence of colored flowers must be regarded as an initial step in this direction, and the greater part of all flowering plants exhibit in a more or less marked manner this evidence of the influence which insects have exerted upon them. But it is evident that an ordinary hermaphrodite flower, however showy or fragrant, if devoid of special appliances for preventing self- and securing cross-fertilization, represents a very rudimentary and imperfect state of correlation to the insect world. This condition, which is now the predominant one, must therefore be regarded as constituting the first step of a long progressive series of morphological changes in the same direction, all tending to complete the degree of adaptation to insect life. The various specializations which a few species have already undergone mark so many additional steps taken by such species toward the same end and afford a faint idea of what the whole flora of the globe might become in the remote future, if wholly uninfluenced by man.

In the great majority of plants, self-fertilization is doubtless still the rule, and cross-fertilization the exception, but this occasional crossing, even though very rare, suffices to maintain the vigor of the stock. Such plants will appear to thrive as well when self-fertilized as when cross-fertilized, and this would probably be the case if the experiment were repeated a great number of times, for it is not once or a score of times, or a hundred times even, that count in these processes of nature, but vast periods and innumerable repetitions, each with its minute differential to add to or subtract from the general sum. When these facts are properly understood, therefore, the partial or total failure of all human experiments on cross-fertilization becomes nothing more than naturalists ought to expect. The really surprising fact in such

[1] See an address by Maj. J. W. Powell, delivered before the American Geographical Society, at Chickering Hall, New York, Dec. 29th, 1876.

experiments is that some of them actually do show a clear difference in favor of cross-fertilization. It may be compared to the attempt of astronomers to obtain the parallax of a fixed star. The result is in the highest degree satisfactory if it is certain that any positive angle is measured. And, as in the astronomical parallax, the greatest exactness is required to measure the vastness of space and its contents, so in the biological parallax equally great precision is needed to measure the vastness of time and its effects.

Independently of insect agency, however, the vegetable kingdom furnishes many facts which prove the unstable state in which the sexual relations are still found to exist.

In many cases it is difficult to determine whether the movement is at the present time towards a greater or a less degree of separation. In a former paper read before this Association[1] I endeavored to bring forward the evidence to prove that certain species of Lauraceæ, and notably the genera Sassafras and Lindera, had already passed through three different stages, of which traces are still left in the form of "rudiments" or obsolete organs. In this case the movement has obviously been towards more complete sexual separation. In the majority of other common cases, such as Smilax, Ilex, Rumex, Rhus, Chamælirium, &c., where the rudiments of both stamens and pistils remain, though one or the other set is functionless and the plants are really diœcious, the direction of development seems also to be towards sexual distinctness, and it may well be doubted whether the flowers of the oak, the alder, or the willow were ever hermaphrodite. Still, progress toward hermaphrodism may also be going on in some species where insect fertilization is found a sufficient substitute for the distinction of sex.

Upon the whole, however, it must be concluded that the special effect of the appearance of insects in the Mesozoic or Secondary age of geology was to render the evolution of new hermaphrodite forms possible, which vastly enriched the world's flora, since prior to that time only diclinous species could survive, and that this great army of plants, having been thus brought into existence in this imperfect condition, have since been gradually throwing off their encumbrance, and at different rates moving forward toward sexual independence.

[1] Published in the *Scientific American Supplement* of Sept. 20, 1879, p. 3089.

A PARTIAL BIOGRAPHY OF THE GREEN LIZARD.

BY SARAH P. MONKS.

THE green lizard *(Anolis principalis)* of the Southern United States is sometimes called the American chameleon, but it is not related to the chameleon of the Old World.

Its changeable coat, however, gives it a popular right to the name. Two specimens of Anolis that I have kept for months in a wire-cloth cage, have shown some interesting habits.

The female came from South Carolina in November, 1879, in good condition, but with the greater part of the tail wanting. She was placed in a small cage and supplied with flies, but refused to eat. During the winter the cage stood among house plants, in a room heated by a furnace, and although she was lively and ran around a good deal, she ignored the flies. Thus she remained without food and water (except an occasional drop that fell by accident when the plants were watered) for four or five months.

But when the warm spring days came, she greedily devoured the flies, and when water was sprinkled in the cage, she eagerly lapped it up with her tongue. It is said that the Old World chameleons drink in the same manner. She would not notice water that was in a small jar in the cage, although very thirsty.

Sometimes when I approach the cage she lifts her head and opens her mouth. I do not know whether she is conscious of asking for water, but I soon recognized this as an indication of thirst. In April a new tail began to show itself, looking like a small black wart, and since then it has grown nearly an inch. At first it was distinct and looked like a graft on the other portion, but now, after several moultings, it is continuous, although it can be easily distinguished from the rest; the scales are smaller, it always remains darker than the rest of the body.

About the middle of May another and larger specimen, a male, came from South Carolina, and I put them in a large box in which were twigs and a stick of wood. After the larger one had dined, their antics on seeing one another were exceedingly amusing.

First, one would raise itself to the full extent of its front legs, and bow its head and the fore part of its body in a regular and dignified manner. It worked as though there was a hinge joint at the shoulders. Then the other would repeat the gesture. The male, when bowing, erected a small nuchal crest, and after several bows, held its head still and stiff and distended a dew-lap.

This expansion, of which ordinarily there is no trace, is not inflated, but is a flattened disc about an inch in diameter. It is orange-red in reflected, and crimson in transmitted light. At this time the lizard is a beautiful sight, the body being green above and white below, and the vivid dew-lap edged with white.

I have seen them bowing several times, but they scamper off on finding themselves watched; and even in the midst of their ceremonious courtship, if a fly comes near they dart after it like a flash of green light.

There is a difference in the change of color in the two specimens, and the same cause does not affect them alike. The female, in the day time, is generally dark-brown, or drab, speckled with white, and has a lighter dorsal line. Sometimes, however, she is grayish. When very dark, even the under side is brown, but when lighter colored the under side is gray, or white. But at night she becomes some shade of green, rarely a pale-green. Once or twice during July I have seen her green in the day time. On the other hand the male is generally pale-green. Their colors are different shades of green, yellow and brown. When changing, the coming color does not suffuse the entire body at once, but first appears on the legs and sides of the head and the body, the dorsal line and tail often remaining darker long after the other parts are light-colored.

When they are green, yellow, or drab above, they are white below; when dark-brown, a lighter shade of the same color below; and sometimes I have seen them a uniform dark brown. Occasionally, the light-green color remains on the eye-lids and a few scattered scales of the body, after the other portions have become brown. They do not always grade regularly from brown, through yellow, to green, but sometimes change from dark-brown to pale-green and white, without showing yellowish. The bronze (yellow) is the rarest color, and is very seldom assumed by the female. They change from one color to another in from two to eight minutes, and one changed from green to light-brown, then back to green again, in five minutes.

I see no reason, as yet, for this changing of color, for it comes regardless of the object on which they are placed, or amount of light and darkness. They become green or light-brown when placed in sun-light, but also assume the same colors in the darkest room. When disturbed, they sometimes get darker, and at other times do not change. Nor do they always appear conscious of a disturbance when a change of color occurs, since I have turned the cage towards artificial light, and found the lizard sleeping and of a green color. In less than two minutes it was dark-brown, and still apparently sleeping. Another time a light held near the cage did not cause one to open its eyes, but in less than thirty seconds a brownish tint had taken the place of the green.

My observations on color-changes have been contradictory and unsatisfactory. The lizards enjoy the sun-light and remain basking for hours motionless, except for their rolling eyes, which notice everything. They go to sleep as soon as it becomes dark, and are not easily disturbed. They also go to bed when a storm brings darkness, and wake again when the sun appears, although not exposed to its direct rays. They are sensitive to degrees of light, but how direct sun-light and darkness can affect their skins and produce the same color-change is a puzzle.

They have several ways of sleeping. Sometimes they lie close up under a bit of loose bark (this is generally on cool nights, or when left out of doors later than usual); at others, they curl in a sigmoid shape in a corner behind a small jar; and at others they stretch out straight and stiff along a limb or among the twigs. And their sleeping habits are the most interesting of any I have noticed. When they are in a crevice, or hole, they take any shape that is convenient, but when on sticks and twigs, they arrange themselves so as to imitate the general form of the branches. In the cage there are some irregular twigs and a small horizontal stick. When on the horizontal piece the lizard stretches itself out straight, with its forelegs pressed closely to the body, and the hind legs and tail so straight along the branch that the bend of the knee shows as a dimple. When sleeping among the twigs it is arranged, head downwards, on the largest, with its forelegs close to the body, but the hind legs spread out at different angles. Often one leg will be straight and the other bent, at other times both have the same bend, but always resembling the branching of twigs. They so closely imitate this when they are dark-brown, that often, at first, before I learned their tricks, I would search for them all over their cage, fearing they had escaped.

The lizards are fond of flies, often snapping up eight or nine, one after the other, as quickly as they can swallow them. I saw one once with two flies in its mouth preparing to catch another.

I never saw them protrude the tongue to catch them. Sometimes, with slightly open mouth, one will creep cautiously towards a fly and seize it with a quick snap, at others they will jump twice their length and catch it. They feed at night if near a bright light. I tried to feed mine with rose bugs (*Macrodactylus subspinosus* Fab.), of which our supply this year has been much greater than the demand, but they refused to have any thing to do with the spiny creatures. After catching a fly they generally move it around in their mouths, seeming to crush and moisten it before swallowing.

In shedding their skins they differ from snakes and such salamanders as I have seen exuviate. The skin splits along the back, and the upper sides of the legs, and comes off in large fragments. It is loose on the legs and tail first; the lizard seizes a bit in his mouth and pulls it off his feet like an inverted glove; then he eats it. Pieces that he scrapes off against the branches, he does not trouble himself to collect as food. It seems a difficult matter to remove the old skin from around the jaws and eyes; I have seen them rub and scratch a good deal and still wear tatters of their old garments around the head for several days after the rest of the body was polished off. I saw one once kick many times at an annoying piece on its head with its hind foot in much the same way a cow will try to scratch her head. He would curve the body and give a vigorous scratch or two, then quickly turn the other side and use the other foot.

When the tail has been broken off and renewed, it skins independent of the rest of the body.

I do not know if there is a regular time for changing skin, but suppose it depends on the general health and the growth of the animal. One of mine changed twice in seventeen days, and the other only four times in five months.

I have found three eggs in the cage at different times, but they soon shriveled up and amounted to nothing.

My specimens occasionally get in the corners and dig at the wires trying to scratch their way out, but generally they seem contented, enjoy basking in the sunshine, and watch me closely with their quick brilliant eyes as though they knew I furnished them with food.

July, 1880.

A NEW LEAF CUTTING ANT.

BY G. K. MORRIS.

ISLAND Heights is the name given to a camp meeting ground and summer resort on the New Jersey coast, near the ancient village of Toms river, and situated on Barnegat bay. For many years the greater portion of the island was neglected by man. It is but two years since the woodman's axe sounded the signal of approaching change. It is now a pleasant summer town.

This summer, early in July, I took up my abode there for the term of my vacation. My first observation was, that the place was an Eden for ants. In an unimproved block two hundred feet square, there are nearly forty species, representing several genera.

Of course most of them are well known; but nineteen of them were strangers to me and such authorities as I was able to consult. These have been sent to Dr. Forel for determination.

One of the number, the most curious and interesting of all, is a leaf cutter, said to be new to science both by Dr. McCook and Mrs. Treat. The worker is a fraction over an eighth of an inch in length. The male and female are nearly of a size, and but little larger than the workers. In color, as seen in mass in alcohol, they are light brown. The head is dark, and a dark band runs down to the point of the abdomen, which on the under side is lighter. The head is rugose, and the entire surface of the body is rough and hard. On the thorax and the metathorax there are short spines. The node is like a rough irregular bead with the thick end next to the abdomen. The mandibles are toothed and seem striated on the outer surface.

When first observed these ants were marching in line, each one laden with a piece of the fine needle-like leaf of pine seedlings. They did not carry their loads as other ants do, but on their heads, resting between two ridges that extend from the base of the antennæ to the top of the head. Some of them carried pieces longer than themselves, in which cases the needle lay along the back, one end being held in the mandibles. Tracing them to the seedling, which was nearly a rod from their formicary, measured by their path, I found them engaged in cutting. It took but a moment for one of them to sever a leaf. Some pieces lay on the ground as if the cutter had been delegated to that work, but as I watched, each cutter carried down the piece he had cut and bore it to the nest.

In the line marching towards the nest, was one carrying a small white stone, and others carrying the striated droppings found under bushes on which worms are feeding. The only other leaf carried by them, so far as I have observed, is the leaf of cow wheat *(Melampyrum americanum)*, a plant which abounds in the woods. Of this plant they collect the flower as well as the leaf.

On the 17th of August I dug out a formicary of the leaf cutter in the presence of Mrs. Treat, who, having heard of my observations, came on to see for herself. Our discoveries were startling. Instead of small cells we found what, in comparison to the size of the ants, may be called caverns. Unfortunately these were crushed by the spade, so that their size and shape could not be accurately determined.

In the cells were masses of spongy material of a leather color, and full of irregularly formed cells or pockets in which were some callow ants and many mature ones. Two of these large cavities were found containing this strange material. It was evident that the ants manufactured the leaf cuttings into a soft nest for their young. There were a few males and females, and one ant without wings much larger than any others in the formicary.

The spongy material broke down with handling, but showed its vegetable origin under the glass. Indeed, a few of the particles found in the first cell, near the surface of the ground, had not entirely lost their green color. Our impression was, that the leaf matter was partially masticated and then webbed together.

On September 8th I selected for examination a nest in a more retired locality, and from which the trees had just been removed. Immediately under the turf, not more than three inches below the surface, was the first cell. It was about the size of a large coffee cup and not far from the shape of one. The sides were smooth, compact and firm, though made in the clean white sand. They were lined with fine yellow sand which had been brought up from a depth of about two and a-half feet. This seemed as if held loosely together by a web-like substance and constituted a thick soft curtain against the walls. On the floor lay a mass of the porous, spongy substance found in the first nest. A few ants were found here differing in size and color; one was nearly red, another brown with dark band, and others grayish. The latter were callow.

Adjoining this was a small cell one and a-half inches in diameter, containing very little of the substance described above. In the loose material on the floor of this cell were found living forms of minute size, and unknown to me.

Five inches distant was a still smaller cell, in which closely stowed away, were ants, apparently prisoners. The approach to their dungeon had been plugged for the whole distance with the yellow sand, so that it could be traced like a yellow streak in white candy.

Three inches below the level of the cells last described was another three and a-half inches deep, two and a-half wide by three and a-half long. In form it resembled a coffee cup flattened slightly. I was fortunate enough to approach this one so carefully as not to disturb its interior arrangement. Having made a pit by the side of it, I carefully cut away the loose sand with a large knife until one side was removed, and the wonderful architecture within was before my eyes. I ceased work in utter astonishment. My excitement was intense, and my delight indescribable.

The floor was covered with small smooth pebbles. The bulged side of the cup was protected by a curtain of yellow sand fully a-half inch thick in the middle and tapering to nothing at top and bottom. The white sand in which all this wonderful work had been done, was packed and smoothed and almost glazed until it had become so firm that no jarring would shake a particle from its place.

But what most filled me with wonder was the resemblance of the interior to a bee hive. Suspended from a tough root at the top of the cell, and nearly filling the entire space, was what resembled a honey-comb in all save regularity of form. There were several masses of it hanging side by side as in a hive. In place of regular cells, however, were irregular pockets, in which the young are reared.

I cannot tell the reluctance with which I removed this comb, nor my regret at the impossibility of preserving it just as it hung. However, it is preserved, though not in form as found, and is before me as I write. It has been seen by Dr. McCook, who has made a study of the leaf cutting ant of Texas. In his opinion the ant I have described is an Atta. He came to the heights and investigated a formicary, but was unfortunate in that the day was stormy. He succeeded, however, in verifying my observations.

COMPARATIVE NEUROLOGY.

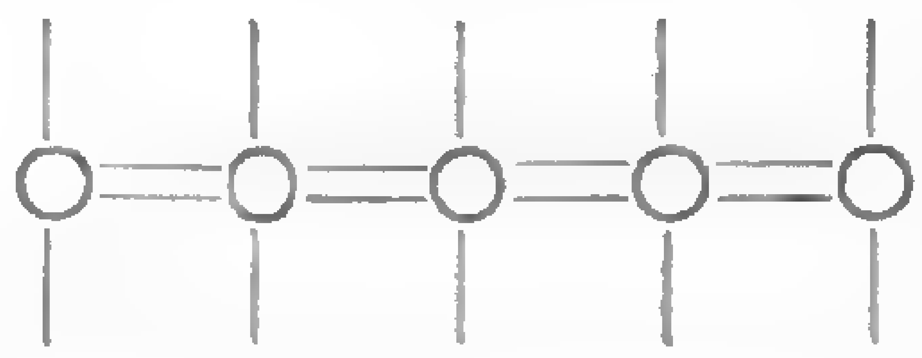
BY S. V. CLEVENGER, M.D.

[*Continued.*]

AT this stage the so-called afferent commissure alone is established, but the same law of unification of segments in the construction of an individual from its component colonial members will also confer upon it an efferent commissural system.

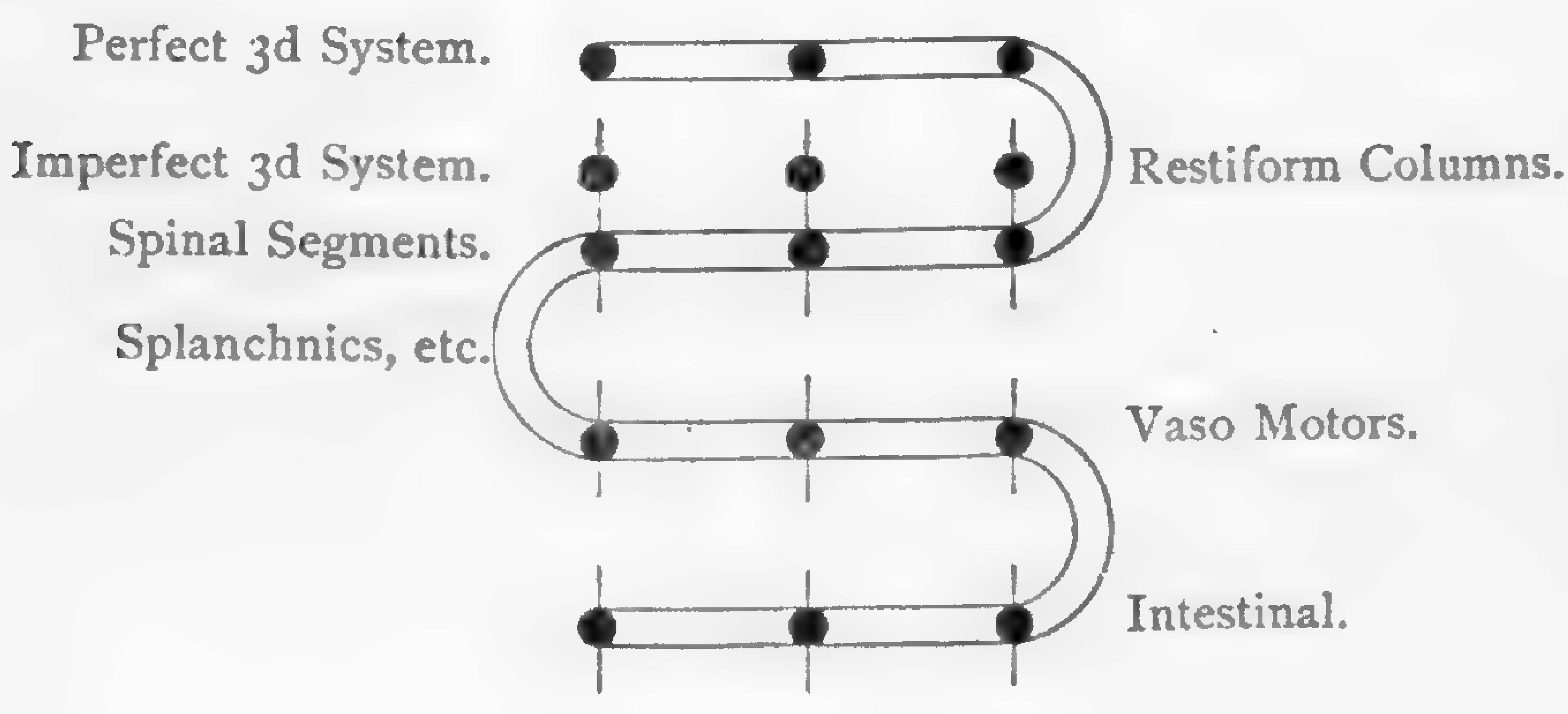
While this is intended to represent the visceral nervous system of Invertebrata, the same rule will apply in the union of vertebral ganglia segments in higher forms, beginning in such Invertebrata as possess more than one secondary system ganglia (some Arthropoda).

Ganglionary fusions occur in parasitic insects and other forms, but this is secondary and does not interfere with the general application. By omitting the afferent part of the fibers that form the commissures, the segmental union may be expressed thus, and confusion avoided:

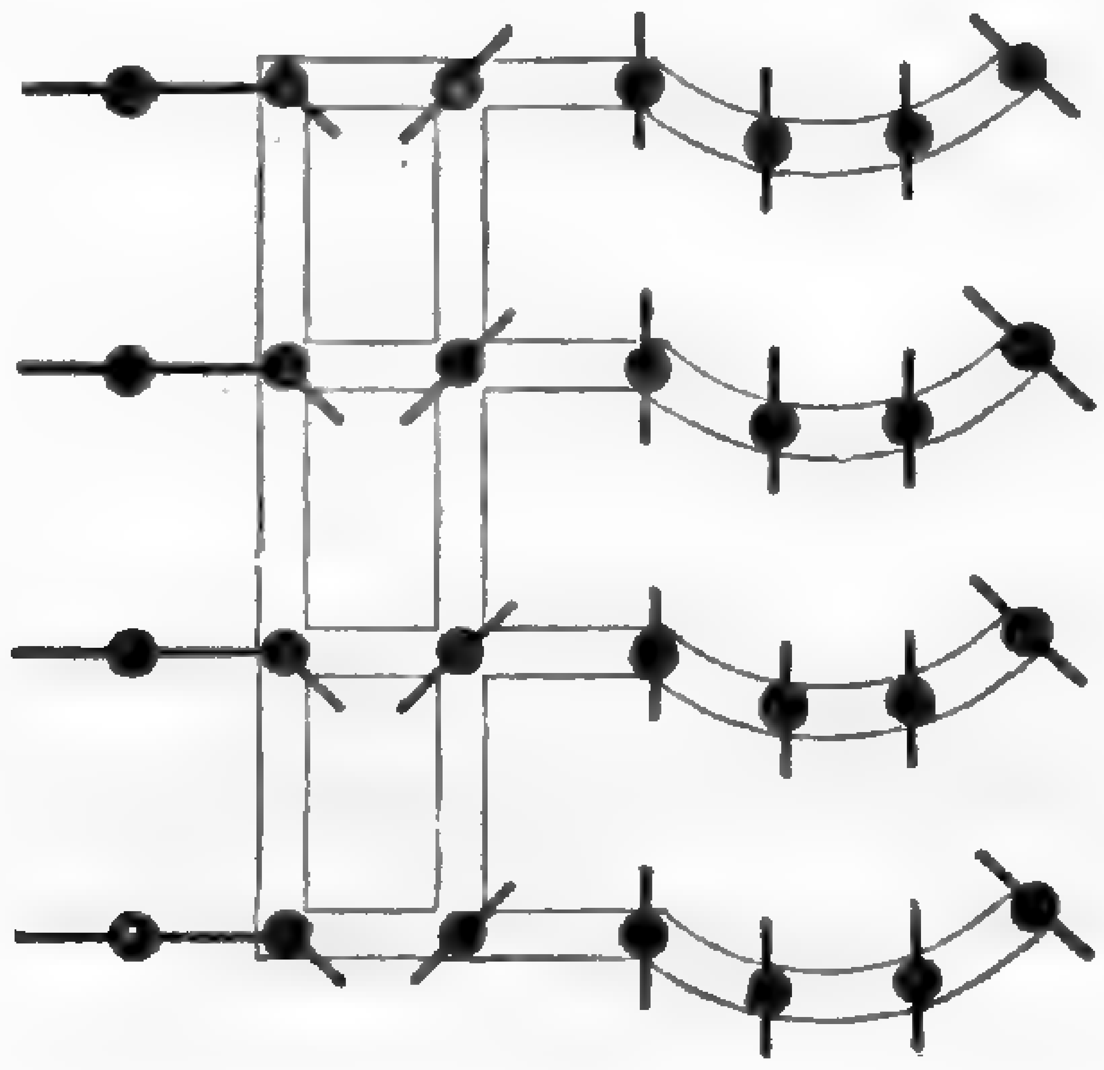


These may be schematically expressed in diagrams which show the higher ganglionic series to be commissurally connected with the lower. Each higher segment presiding over a lower system series and the commissures between forming apparently, direct projection systems.

This scheme would explain why the splanchnics have no inhibitory control over the intestines (Ludwig and Haffter), such control really pertaining to higher projections (Ott).



Each spinal ganglion segment presiding over a similar series would be thus represented:



While each and every ganglion preserves its primary projection functions, the commissures interrelate the systems and are themselves projection fibers.

The third system in this diagram is incomplete in not being commissurally connected, hence it is but a ganglionic (intervertebral) swelling upon the secondary spinal afferent nerves, and attains its complete functional character within the cranium only.

In Trigla adriatica the brain and dorsum of the cord are marked by a double chain of well-developed tubercles on the secondary nerves just as they enter the cord. These ganglionic enlargements are exact reproductions of the cerebellar and cerebral enlargements, en chatelaine. These intervertebral ganglia constitute the third system, the difference between the spinal ganglia and those above being that the latter are commissurally united to one another, and in higher Vertebrata fused longitudinally.

The vermis of the cerebellum is probably a mere commissure compounded of different segmental heights, for the transverse striations are pronounced in birds and some reptiles.

According to Owen, the cerebellum (vermis) retains its embryonic form of a simple commissural bridge or fold in the parasitic suctorial Cyclostomes and sturgeon, and in the almost finless Lepidosiren, while the cerebellum (still vermis, because centrally placed) is highly developed in the sharks. In the saw fish it even rests upon the "cerebrum."

The first well-marked posterior ganglionary mass which in higher Vertebrata becomes a portion of the cerebellum, is the vagus tubercle, placed posterior to and below the "cerebellum" of the fox shark. It might be safe to assume that subsequently this tubercle (third system ganglion) forms the flocculus or pneumogastric lobule of the cerebellum.

The Gasserian ganglion (unmistakably an intervertebral), where non-existent, must form a portion of the cerebellum.

The cerebellum then appears to be formed from fused hypertrophied intervertebral ganglia.

Stilling regarded the law of isolated conduction as inapplicable to the cerebellar lobes, owing to the very great commissural (fused) union which occurs there. Thus a coördinating function between cranial nerves on the one hand (the cerebellum acting as connected intervertebral ganglia for many cranial nerve fibers), and the general spinal system on the other, must follow in such Vertebrata as are governed mainly by cerebellar supervision, while in higher forms it is brought directly into relation with the cerebrum itself.

Above this the cephalic intervertebral ganglia developed in some animals, atrophic or rudimentary in others, appears to be the posterior and anterior tubercula bigemina, epiphisis cerebri, eminentia mammillaria, olfactory lobes, cerebrum, which latter is itself composed of several lobes or ganglia, some of which, as the anterior, are undeveloped in most Vertebrata and even in many mammals.

The posterior bigeminal lobe appears to be a third system ganglion related to special tactile sense (see Spitzka, N. Y. *Medical Record*, March 13, 1880), while the optic lobes (anterior bigeminal) are third systems for the optic nerves. The primitive optic fibers were related to the gray matter above the chiasma, and even in man retain some primary thalamic connections.

The epiphisis cerebri (pineal gland), bilobed in the fœtus and devoid of sabulous matter in forms below man, attains quite a large size in some animals (*Meleagris gallapavo*, p. 260 "Huxley's Vertebrates"). It may with the mammillary eminence indicate a sense between sight and olfaction.

The mammillary eminences can be third systems, their positions and cinereal envelope weighing nothing against the idea, for the Teliost cerebrum itself drops to a comparably defective structure and inferior position.

These eminences are very large in monotremes, marsupials and the horse. They stand related to the fornix, which in turn is connected to the olfactory lobe.

The olfactory lobe (another third system ganglion) appears to have been derived from a place lying in front of the mammillary eminences, according to Luys' sections, but Meynert is doubtless more correct in attaching the olfactory primitively to the optic thalamus.

The olfactory lobes, of more importance in some vertebrates than the cerebrum, in man became strangled, so to speak, by the preponderance of higher third systems.

("The olfactory lobe bore such important relations to the life history of early vertebrates that we are not surprised to find the *cerebral hemispheres* developing at first as mere appendages of the olfactory lobes."—Spitzka, "Architecture and Mechanism of the Brain," p. 37.)

The lobes of the cerebrum are related to the corpus striatum, which seems to be a part of the medullary gray second system, though formed after the hypophysis cerebri had become atrophic as the end of the spinal cord.

The hypophysis ended in the sella turcica and the corpus striatum (caudate nucleus), and subsequently lenticular nucleus developed in the scale of intelligence (Meynert).

In Teliost fishes the optic lobe (third system) occupies the place of the cerebrum of mammals in point of mass development, and the inference is natural that this optic lobe contains the highest centers related to the psychic life of this division of vertebrates. The cerebrum proper being an undeveloped tubercle in front of the mammillary eminence with the infundibulum between them (Todd, p. 619, Vol. III).

In Amphioxus we have the culmination of the secondary ganglionic type with the foreshadowing, seemingly, of the tertiary, in the black pigmentary formation in the dorsal portion of the notochord. This vertebrate, so far from being anomalous, explains by its rudimentary organization what appears later in the Cyclostomi or above. Its second pair of nerves runs from the dorsal segmental nerves to the head-end ganglion, thence to the ventral segmental nerves, typifying the medulla oblongata control over lower centers, without the intervention of a cerebellar or any other third system.

The optic ganglion (secondary) of the crab *(Carcinus mænas)* topographically precedes the antennal, from which may be inferred that the posterior bigeminal (tertiary) is related, as Spitzka claims, to the special tactile (fifth pair) sense.

The slight development of the superior ganglia in Brachiopoda is correlated with higher sensory organs, and Gegenbaur, p. 310, notices that the nerves for the arms are probably given off from the *ventral ganglia*, a condition which I suspect is more common than usually thought to be the case, due to the want of differentiation between alimentary and locomotor parts, so far at least as central innervation is concerned. "In the Mollusca the visceral ganglia are not only of importance, as forming a part of the general nervous system, but they may also fuse with the cerebral ganglia, owing to the gradual shortening of their commissures. New and primitively peripherally placed parts are thereby added on to the central organs, and it becomes a matter of doubt whether or no these ganglia, which formerly belonged to the visceral nervous system should still be regarded as belonging to it."—Gegenbaur, p. 344.

The development of the nervous system appears to have proceeded as follows:

PRIMARY.

Intestinal—Circulatory and visceral, cardiac.

SECONDARY.

Respiratory—Special tactile locomotory, auditory, optic, or optic and next auditory.

Antennal special tactile from which auditory in some ; (olfactory not certain in Invertebrata, possibly in Cephalopoda. *In Vertebrata originate highest secondary and tertiary).*

The progression of faculties intermingle and a branch sense appears often to develop indifferently from one or other trunk, as while respiratory may give rise to the tactile for locomotion, and audition follows upon this, the antennal for gustatory purposes may originate the auditory, while locomotor tactile may be developed separately.

NERVOUS ORGANIZATION OF INVERTEBRATA.

1. *Protozoa.*—Not perceptibly differentiated.
2. *Cœlenterates.*—Rudimentary primary.

3. *Vermes.* 4. *Echinodermata.*	Secondary appears and becomes highly developed. Often fused with primary.
5. *Arthropoda.*	Secondary well developed. In Insecta the primary quantitatively developed. Tertiary pronounced in bee.

6. *Brachiopoda.*—Degraded secondary.

7. *Mollusca.*
- Resemble Vermes.
- Secondary feeble in Lamellibranchiata.
- Secondary well formed in Gastropoda.

8. *Tunicata.*
- Secondary well defined (extending by commissures dorsally (?) Copelata).
- First appearance of extended secondary in Invertebrata.
- Anterior ganglia vesicularly developed.

Gegenbaur (p. 501) justifies this view of the central nervous system of Vertebrata being homologous with the superior central ganglia of Invertebrata "in an exceedingly high state of development."

The dorsal position of the central nervous system can be well made out in Tunicata. It proceeds from ectodermal differentiation.

An anterior larger mass divides into three consecutive (secondary) lobes, produced by unequal thickening of the walls of the central tube.

The anterior mass is in connection with the origin of the visual organs in Ascidiæ, Salpæ and Copelata.

A median dorsal nerve cord appears in ascidian larvæ, which prolongation Gegenbaur, p. 396, regards as noteworthy as being the only *dorsal* prolongation in Invertebrata, and thus a medullary secondary central system appears stretching the length of the animal.

Notwithstanding the feeble development of the cerebral ganglia in Mollusca, the homology of these ganglia with the cerebral ganglia of Vermes and of Arthropoda has been clearly made out. There exist in Arthropoda and Mollusca cerebral (secondary) ganglia connected with nerves of special sense and visceral (primary) ganglia innervating, in Mollusca, the heart, branchial apparatus and generative organs, comparable to the "stomato gastric nervous system" of Arthropoda.

The ventral chain of ganglia, so obvious in Crustacea and Insecta, partakes of primary or secondary characteristics, or both, depending upon the position of the metamera and the degree of development they have undergone. With concrescence of the anterior metamera into a more or less extended cephalothorax, the anterior ganglionic masses are fused, as in Stomapoda, where a portion of this ventral chain innervates the anterior buccal and and prehensile feet, while the six smaller ganglia of the abdomen still correspond to the segments and have more apparent primary than secondary significance. In Arachnida, where nerves are given off to the enteron from both the cerebral and ventral ganglia, an appearance is presented of the vertebrate pneumogastric projection.

Recent embryological observations, as set forth by Balfour ("Comparative Embryology," Vol. I, 1880) from monographs of Kowalevsky, Kleinenberg, Fol, Lankester and others, distinctly show that where the nervous system has been made out at all, as a rule it proceeds from epiblastic thickening and differentiation.

The First System arises from intestinal innervation, the ganglion of which affords, in Invertebrata, locomotor nervous control. The respiratory, digestive, and excretory functions, as in larva of dragon fly and fish Cobitis, being performed, not only by the same sets of nerves, but the same organs (*vide* Darwin's "Origin of Species," p. 170). We have seen locomotion to proceed as an accidental accompaniment of respiration (Branchipus), and the sub-œsophageal ganglion innervating the second pair of antennæ in Nauplius.

The vaso-motor division of the first system is added when the mesoblast appears and the vascular is differentiated. The concentration of the fibers and ganglia of this system in certain areas, as the solar plexus, renders any attempt at systematic classification of strands, etc., futile, but by studying the arrangement of the sympathetic system backward from the præ-vertebral ganglia, the warrant for the scheme I have adopted is more apparent. The præ-vertebral are united by longitudinal commissures, precisely as in the ventral chain of ganglia in Arthropoda; often as in the cervical region these ganglia coalesce to form larger nerve centers, precisely as in cephalo-thoracic formation from metamera, or as in the leech; one ganglion may in the adult represent three of the embryonic segmental ganglia.

No matter how exalted the function or position pertaining to a ganglion *in any system*, it does not lose its identity as a simple center from which afferent and efferent fibers proceed. The præ-vertebral chain presides directly as centers over the immediate vascular area with which it lies in contact, with its more or less obscure peripheral projections, while the commissural system binding it to the visceral plexuses lengthen and broaden out into such great fasciculi as the splanchnic and cardiac nerves.

Second System Ganglia.—By quantitative caudal development of the cerebral ganglia homologies of Invertebrata, as supra-œsophageal, optic, auditory, pedal, or tactile, commissurally connected by afferent fibers posteriorly (columns of Goll and Burdach), and by efferent fibers anteriorly (columns of Türck and anterior fundamental tract), a view is obtained of the primitive spinal cord segments ununited. Spitzka records that the planes of junction of the original segments may be still made out by the poorness in cellular elements of such areas under microscopic examination, while the centers of the spinal ganglia are determinable by their richness in these elements. Longitudinal fusion and consequent shortening of this chain forms the central tubular gray of the spinal cord.

The "medullary white" of Flechsig first appears in the columns of Burdach, in the fœtus of 25 c.m. Spitzka says it also appears in the processus cerebello ad cerebrum. This is reasonable, for the processus cerebello ad cerebrum is a continuation of the columns of Goll and Burdach, as will appear later in this description.

The second system ganglia consist of:

1. All the coalesced segments which form the spinal cord.
2. The medulla oblongata gray.
3. The gray masses in the pons Varolii.
4. The optic thalami and soft commissure.
5. The tuber cinereum.
6. The (doubtful) olfactory ganglion of Luys.
7. The caudate and lenticular nuclei of the corpora striata.

The hypophisis cerebri being the atrophied end of the cord, needs no numerical consideration.

Third System Ganglia.—Turning again to the Amphioxus, we find that the second system ganglia, or spinal cord, give off afferent and efferent nerves dorsally and ventrally, *without intervertebral ganglia, cerebellum, or anything resembling a cerebrum.* The "second pair" of nerves of the head end, instead of passing ventrally and dorsally, as do those of the lower segments, run backward or caudally; those which run from the tail to the head along the dorsum, are afferent, while those projected backward along the ventral portion of the body, are efferent.

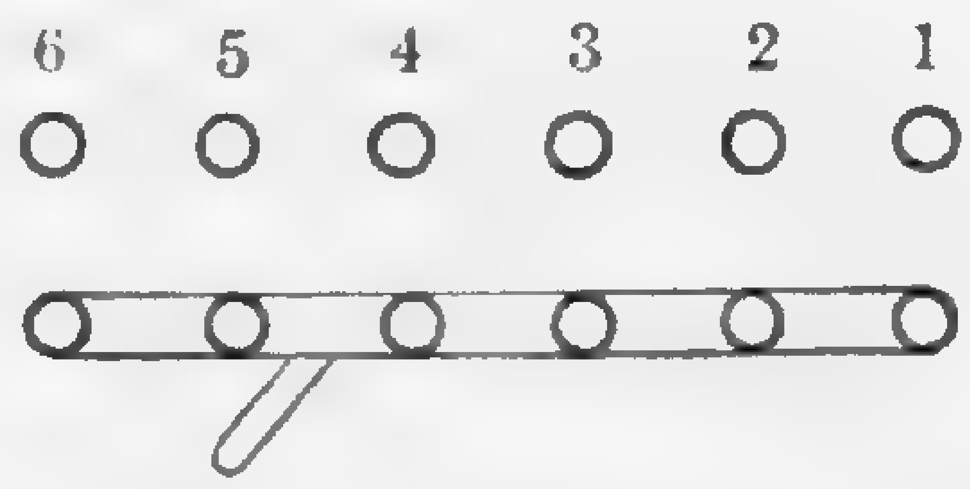
These sets of nerves resemble strikingly in many particulars, the pneumogastric nerves *and the lateral columns of the spinal cord* of higher Vertebrata. Confer ganglionic swellings upon all these afferent spinal nerves of the Amphioxus, proportioning their sizes to the nerve bundle sizes, and an appearance is presented like that which obtains in *Trigla adriatica*, a series of dorsal (intervertebral) ganglia from tail to head forming intervertebral ganglia, cerebellum, optic lobe (so-called cerebrum), and the higher series differ from the lower only in point of mass.

The crura cerebri and tegmental fibers thus become efferent and afferent nerves from the higher homologues of the central tubular gray; the corpora striata and optic thalamus, and these fibers with part of the restiform column project at different levels *from and to the spinal gray as peripheries* along the antero and postero-lateral columns of the cord. But this does not comprise *all* of the projection series from these parts for the cerebro-spinal nerves have their primary projections as well.

Morphology of the Third System Lobes.—The position of the cerebellum and its recognizable phylogenetic changes may be easily traced through the Vertebrata generally, but the lobes superior to it undergo a variety of distortions and changes of position, for the solution of which we must resort to schematic views.

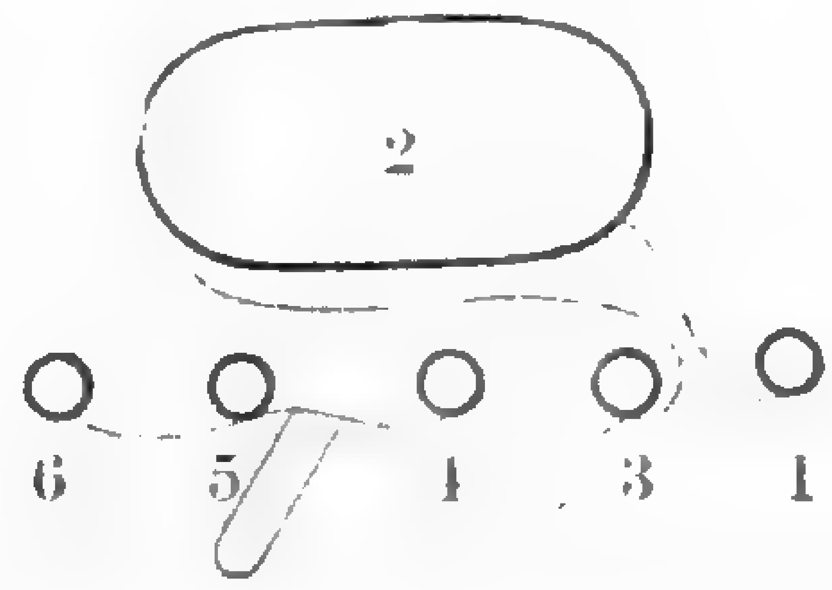
Given, a series of tubercles which shall from behind forward represent the lobes of the brain, as follows:

1. Posterior pair of tubercula quadrigemina.
2. Anterior pair of tubercula quadrigemina.
3. Epiphisis cerebri.
4. Mammillary eminence.
5. Olfactory lobe.
6. Cerebrum.

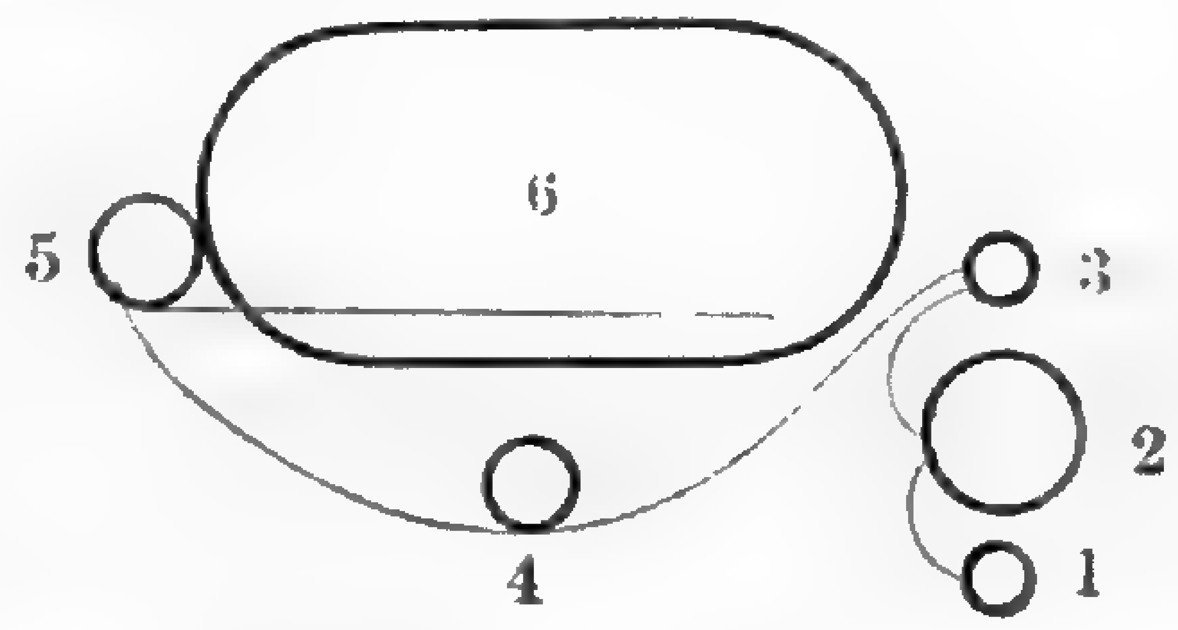


The gray secondary of each being united by commissures, the afferent and efferent. The first of these commissures it will be most convenient to follow through the developmental gyrations as apparently connecting the under surface of each lobe, but in reality connecting the secondary segments pertaining to each, as optic thalamus, tuber cinereum, olfactory ganglion and corpus striatum.

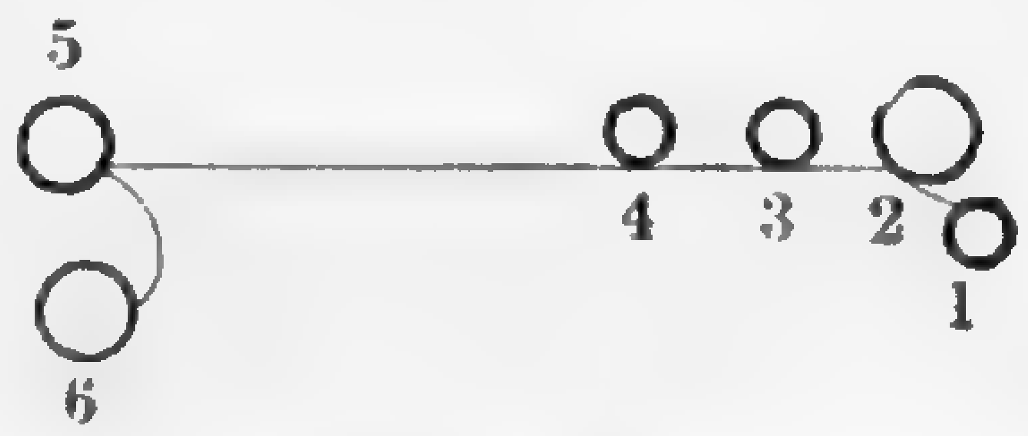
1 is connected to 2 and 3 by the upper end of the brachium conjunctivum, 3 to 4 by prolonged habenulæ, 4 to 5 by fornix, 5 to 6 by hippocampal fibers, tractus Lancisi and gyrus fornicatus (the latter principally). In the case of a fish with optic lobe (2) developed covering the other tubercles, the course of the commissures and relative mass appearance would be thus :



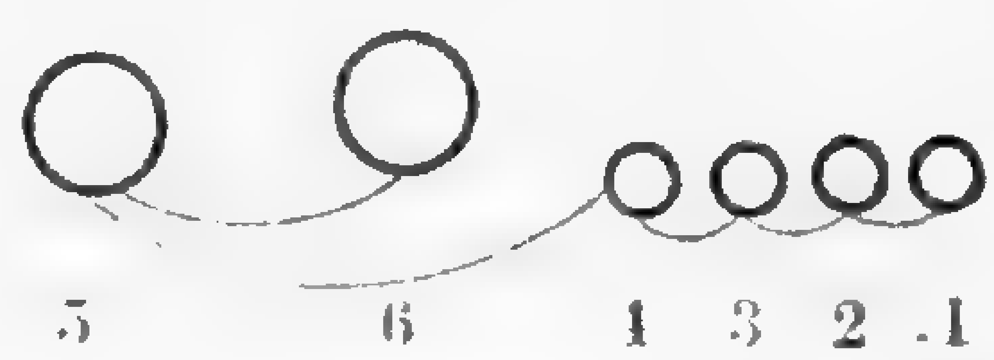
Bird, as pigeon, with cerebrum developed covering 1 to 5, the optic lobe being pressed to one side.



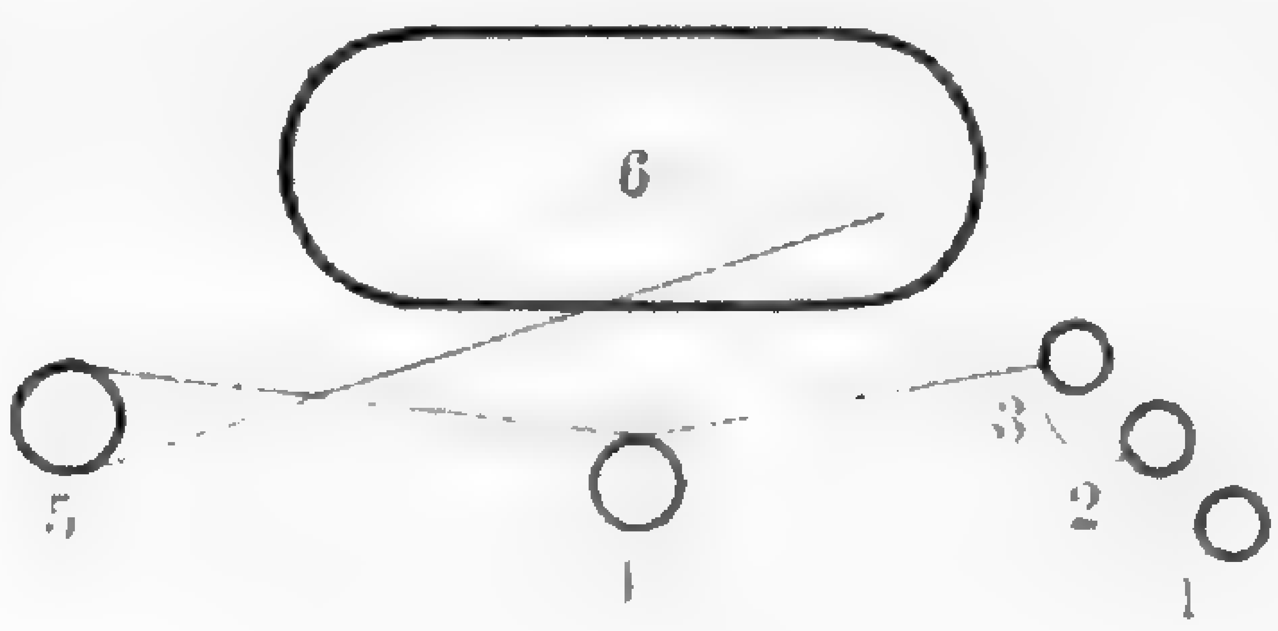
The following appears to be the arrangement of the brain of the fox shark, with lobes equally developed. I think the main mass must be the optic thalamus with the quadrigeminal bodies fused on its surface (this latter feature not represented here).



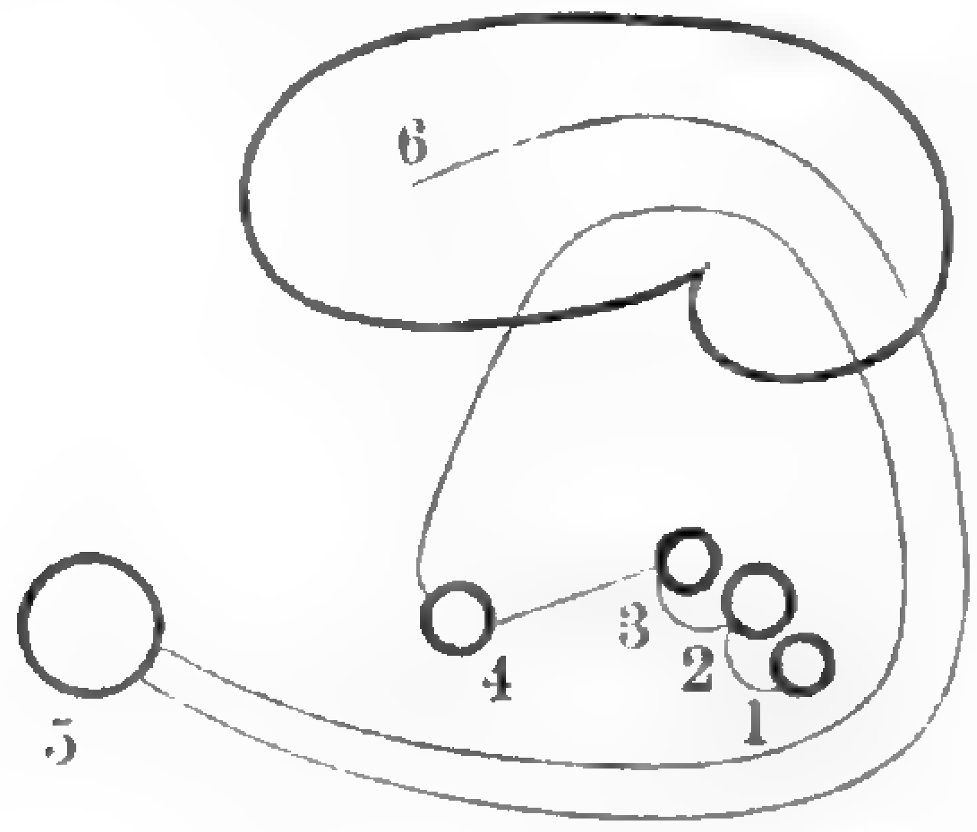
This form appears in the mammal with equally large olfactory lobe and cerebrum.



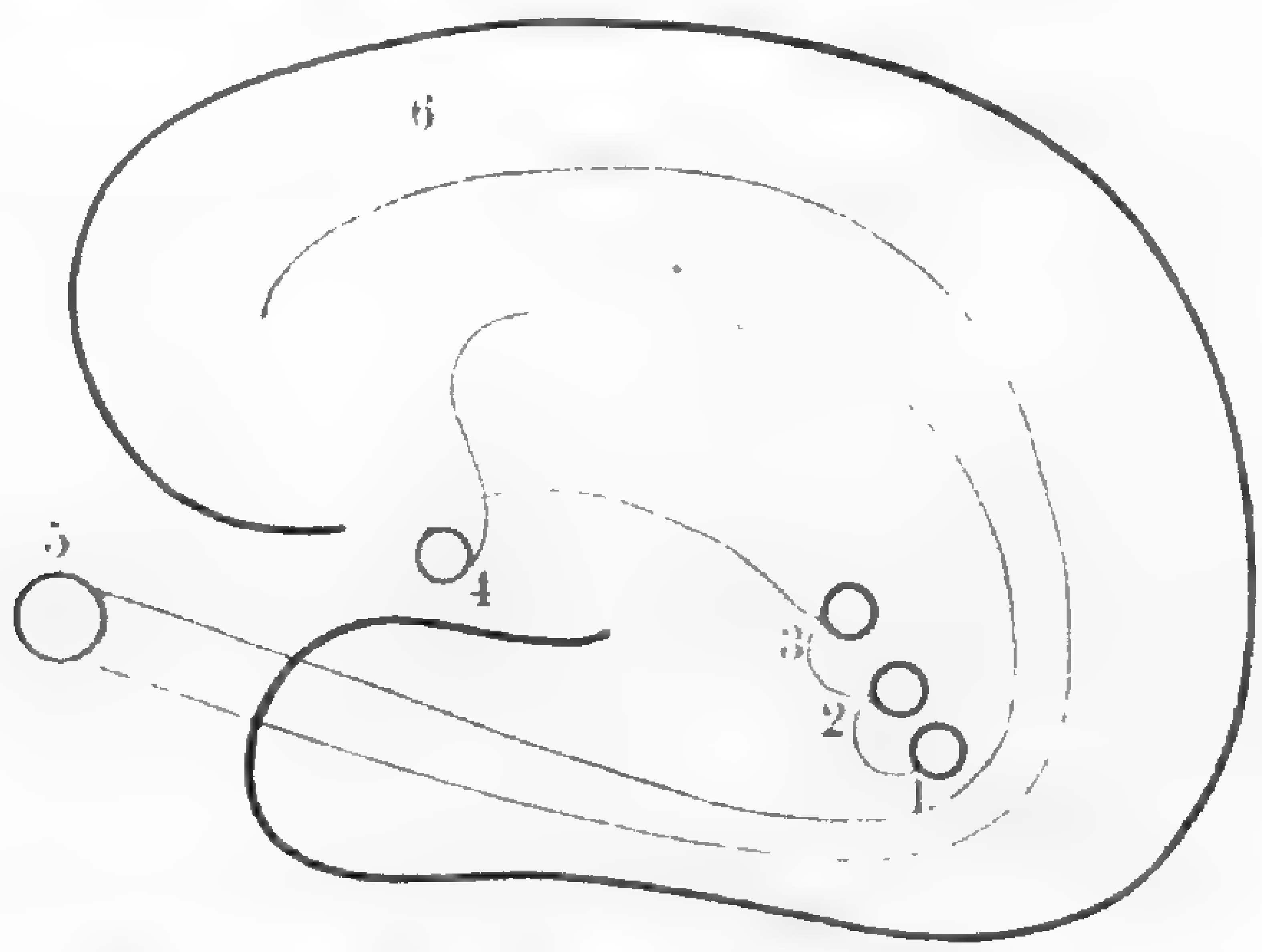
Evolution of the afferent longitudinal commissures, fissure of Sylvius and temporal lobe.—This condition is presented by an unconvoluted brain such as the beaver's, which is but faintly fissured.



An illustration of the gradual appearance of the Sylvian fissure with the hippocampal formation, is attempted below :



The last cut represents the Sylvian fissure formed as in man, with the accompanying fascicular distortions :



The growth of the frontal lobe in proportion to the intelligence of the primate individual, augments this creation of temporal. Many of the longitudinal sulci of the quadrumana fold over and under with this advancement of the occipital into temporal, and the parieto-occipital fissure on the median face of the cerebral hemisphere is doubtless created directly by this bend, and the calcarine may also owe its origin to this change. A variety of causes combine, however, in fissure formation, aside from those mentioned.

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THE BEE'S TONGUE, AND GLANDS CONNECTED WITH IT.

BY JUSTIN SPAULDING.

THE present paper is the outcome of an interest in the subject awakened by an article, by Mr. J. D. Hyatt, on the sting of the honey bee, in the *American Quarterly Microscopical Journal* for October, 1878, followed by one on the structure of the tongue by the same, July, 1879. Both bear impress of careful and pains-taking interpretation of facts, and a genius in manipulation that is truly marvelous. Mr. Chamber's article, prior to Mr. Hyatt's and which he criticises, I have not seen, and am indebted to Mr. Hyatt for what knowledge I possess of it. His article on the bee's sting, reading so like a fairy tale, incited me to attempt to demonstrate for myself if it was indeed the marvelous little structure described, and I can add my testimony (which he certainly does not need) to the literal accuracy of description, drawing and, as I believe, of his interpretation of the bee's manner of working it. That the bee can sting, every boy of ordinary enterprise can testify from personal experience, but Mr. Hyatt has spread before us the whole villainous apparatus, and initiates us into every motion, so that if one could be philosophical (under the circumstances a hard thing to do, even deacons are said to forget themselves and indulge in a mild form of profanity) the various stages of agony could be explained in learned terms, up to and including the final jab of the two blades, that leaves the victim to retire, swell up, and figure out his net gain from the operation. But to pass to the other end of the bee, which directly concerns us in this article.

My own observation, so far as the ligula is concerned, agrees with Prof. Cook's (see NATURALIST, April, 1880), and I think he has given the true solution when he says it consists of a sheath slit below, within which is the grooved rod, and projecting from the edges of the latter to the edges of the sheath, is a thin membrane, forming, as will be easily understood, when the rod is extended or thrown down, an enclosed sack, open only at the top. For the benefit of those who may still doubt as to this structure, I have drawn, under the camera, a very fine cross section of the ligula, kindly loaned me for the purpose by my friend, Mr. David Folsom. He has succeeded in cutting it from a specimen with the rod thrown out of the sheath (see Fig. 5).

In going over the work of Mr. Hyatt, while examining a mounted specimen of mouth parts, my friend, Mr. F. B. Doten, pointed out, in the mentum, a small spiral tube that gave me a clue, which followed up, has resulted, as I believe, in a slight addition to our knowledge of the parts. I am unable to find any mention of the glandular structure, a description of which follows. The drawing, No. 1, showing the head, is somewhat diagramatic; structures that might confuse being neglected. The specimen here represented was taken while fresh, pressed flat, dried under pressure, bleached in turpentine and mounted in damar.

It shows the structure as represented, from the tip of the ligula

FIG. 1.—Diagramatic. *a*, point where spiral tube enlarges; *m*, mentum; *sm*, sub-mentum; *l*, mandibles; *b*, opening into mouth; *c*, entrance of ducts from head; *d*, junction of ducts from thorax; *g*, glands in thorax.

to the opening in the mouth at *b*. Beyond that I had to resort to dissection, not extremely difficult with a sharp scalpel, a steady hand and patience. It is best performed on alcoholic specimens, and the magnified drawing, under camera, of the gland from the thorax (see Fig. 3), it will be understood is somewhat shrunken on that account.

Running the scalpel from the base of one mandible back across close to the neck and forward to the other mandible, turn forward and pin, remove the brain and salivary glands; cut the œsophagus as far forward as possible, turn it back, and if all has been done carefully, one sees coming from the thorax the spiral ducts of two glands, which will be found, on following back, lying one on each

Fig. 2.—Fragment of glands of head much magnified.

side of the œsophagus, in the space between the muscles of the wings. I have given one of these, Fig. 3, magnified thirty-five diameters, as drawn under the camera. It could be but little more than outlined, as it was a dense mass of coiled and twisted glands, the true structure of which is shown (Fig. 4) still more magnified.

At the base, the duct enlarges, as is seen, into quite a reservoir. The ducts unite within the neck, or just as they enter the head, and following the floor of the latter, are joined by a pair coming in right and left (Fig. 1, *c*). Following up one of these side glands, we find it dividing into three main branches, ultimately terminating in glands, the structure of which is shown in Fig. 2 much enlarged. It will be seen that the glands from the thorax bear a striking resemblance to the Malpighian tubules of insects, while those from the head are larger, different in shape, and composed of much smaller cells. Keeping to the floor of the head, the main duct passes on to the sub-mentum. Here on joining the spiral tube coming from the ligula, it passes by an opening common to both into the mouth at *b*, Fig. 1. Below the opening the spiral tube dips into the mentum, and is imbedded in its muscles.

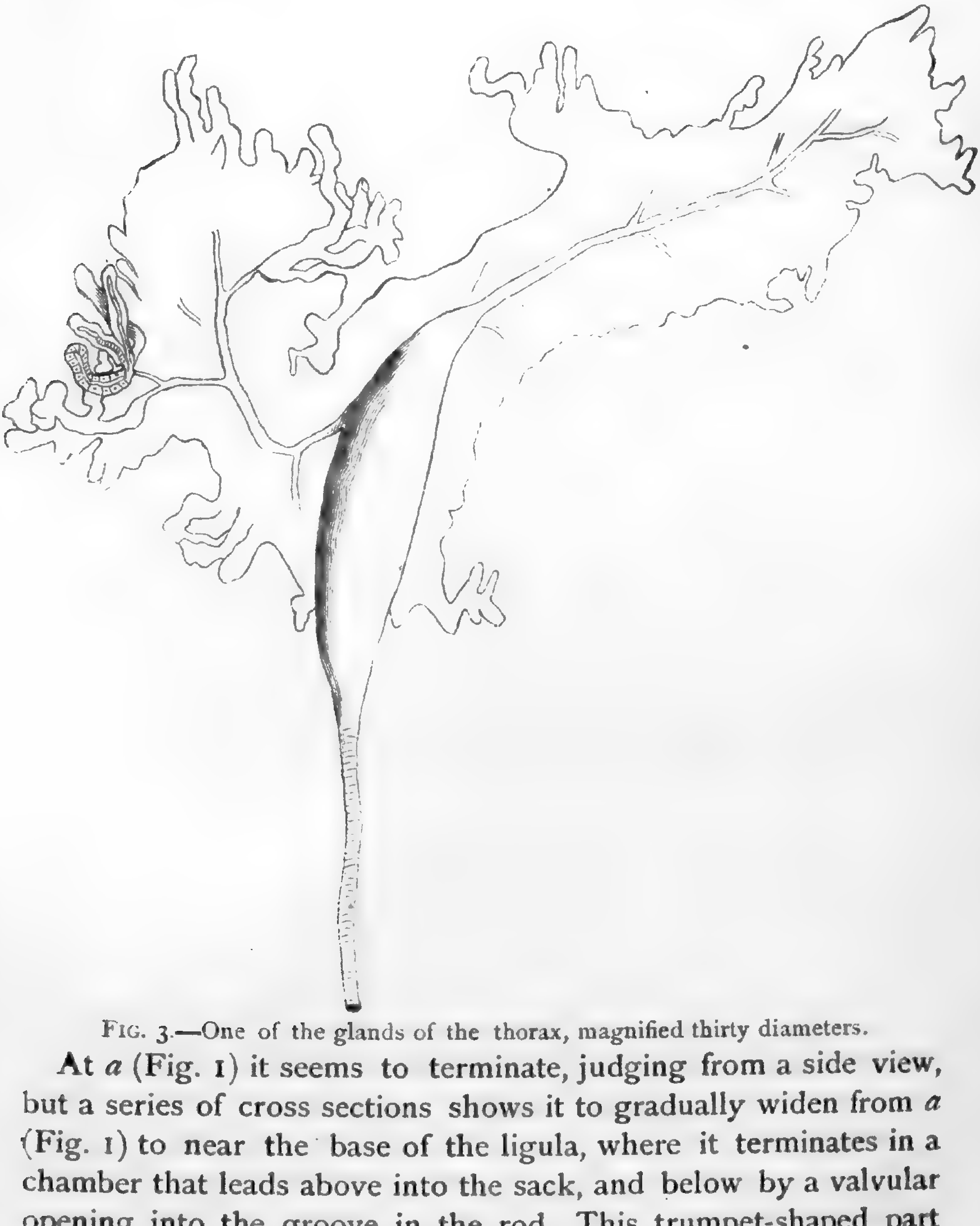

FIG. 3.—One of the glands of the thorax, magnified thirty diameters.

At *a* (Fig. 1) it seems to terminate, judging from a side view, but a series of cross sections shows it to gradually widen from *a* (Fig. 1) to near the base of the ligula, where it terminates in a chamber that leads above into the sack, and below by a valvular opening into the groove in the rod. This trumpet-shaped part from (*a*) to the chamber at the base of the ligula, is collapsed, the upper half of the tube being pressed down into the lower half.

Thus we have a passage from the tip of the ligula through the groove in the rod, and the spiral tube in the mentum to the opening in front of the pharynx, above the labium and between the mandibles. This opening is transverse, and seems to have lips, and from its appearance we should expect it to close like a valve, if suction was applied below.

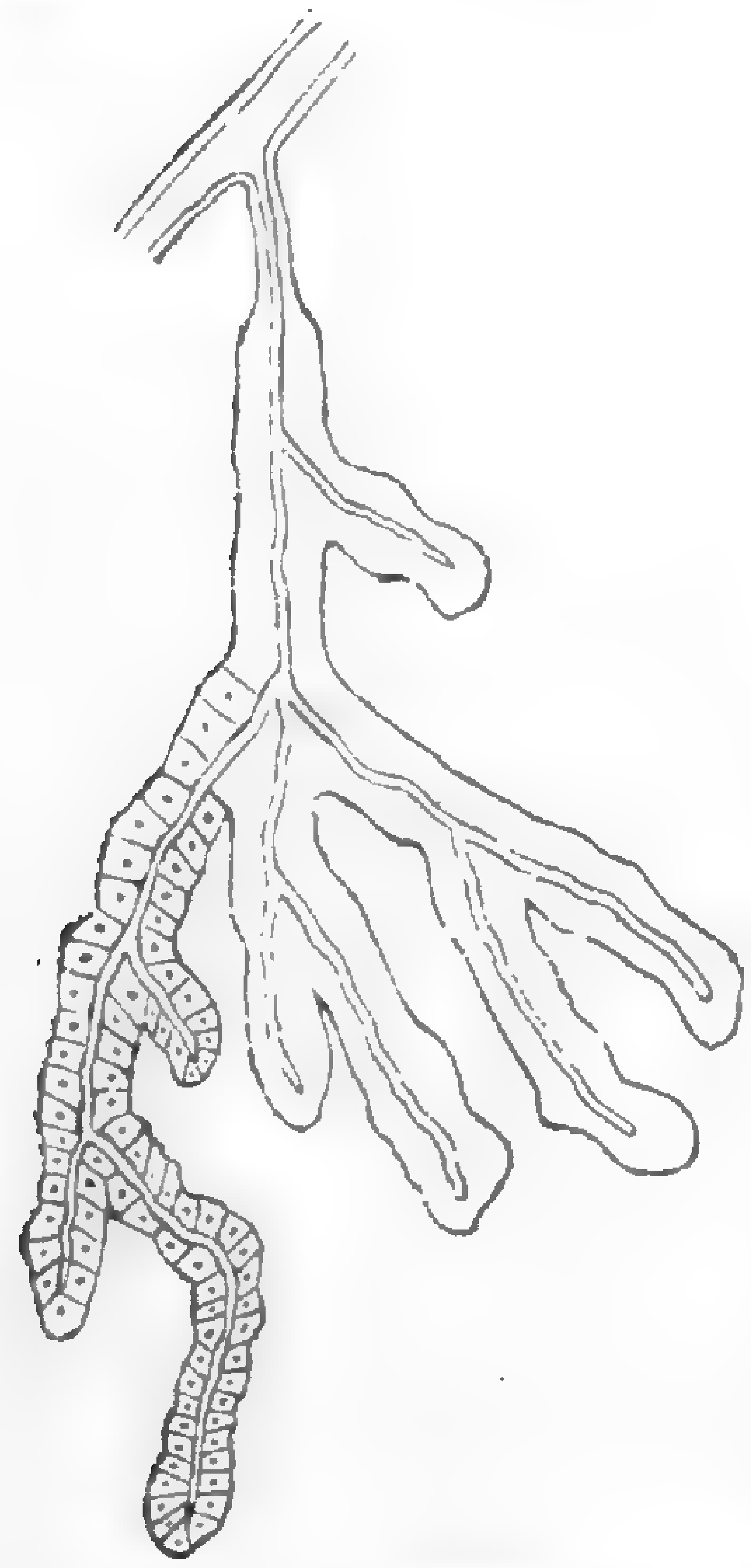

Fig. 4.—Fragment of glands of thorax much magnified.

Meeting this tube from the ligula, and discharging its contents through the same opening into the mouth, is the spiral duct from the glands of the head and thorax.

The questions are at once thrust upon us, whence comes this structure? and of what use is it to the bee? If I was wise the article would end here, but our inclination to explain everything by resorting to speculation, is always strong in the absence of facts to curb it. It seems but natural from the size, position and outlet of the glands, connected as they are with an inlet for the nectar of flowers, to conclude that they are organs that furnish the animal secretion that changes nectar into honey, and I would venture the suggestion that they may be the spinning glands of the larvæ modified. If this is true, I should expect to find them either in an active or aborted condition in nearly all Hymenoptera.

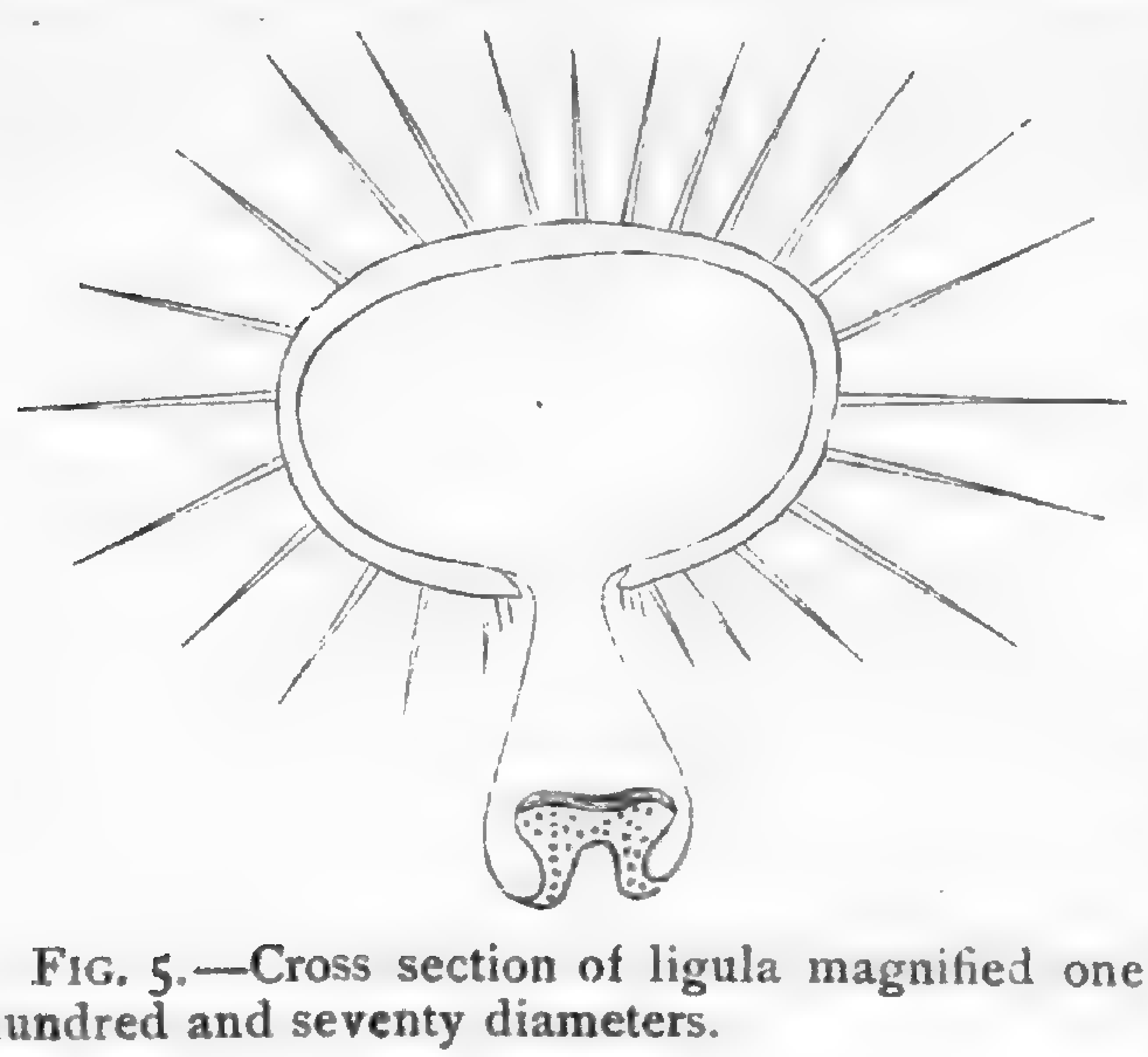

Fig. 5.—Cross section of ligula magnified one hundred and seventy diameters.

Another question raised, is, in what way is nectar carried from the flower to the mouth? This must be, from the nature of the case, largely a matter of speculation. Prof. Cook, in his article, says: "The tongue is also retracted and extended rythmically while the bee is sipping." May not this motion be due to a pumping action of the grooved rod of the ligula, that enlarges and diminishes the size of the sack lying behind it? It would seem that the bee has perfect control of this rod, that it is remarkably elastic, and capable of much extension and contraction. The rod and sack thus acting as a suction and force pump, as will be easily understood by one familiar with the parts.

Of course I cannot say that the bee makes this use of it, but I do say it should, and if it does not, it is pure stupidity on its part. And if some one demonstrates that I am all wrong now, evolution, at no distant day, will set me right, for there will be born a bee, less conservative, that will dare defy old usages, and take a new departure; that bee, trust me, will make use of this cunningly-devised apparatus, and produce honey cheaper than any competitor, excepting the glucose man, and I hope and trust may worry even him.

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HISTORY OF THE BUFFALO.

BY CAPT. WM. E. DOYLE.

THE early adventurers to the new world gave quaint and oftentimes exaggerated descriptions of the novelties they encountered, and the "monarch of the plains" met with a due share of notice at their hands, as will be seen from the subjoined extracts from their narratives.

The first account we have of the buffalo is given by the explorer Guzman, who saw herds of them in Cinaloa, New Spain (Mexico), in 1532.

In 1539 Father Marco de Nica, in his expedition in search of the famed kingdom of Cibola, says that in the kingdom of Ahacus (now in New Mexico) "they showed me a hide halfe as big againe as the hide of a great oxe, and told me that it was the skin of a beast which has but one horne upon his forehead, and that this horne bendeth towards his breast, and that out of the same goeth a point right forward, wherein he hath so great strength, that it will break anything how strong soever it may be, if he runne against it, and that there are great store of these beasts in that countery. The colour of the hide is of the colour of a great goat skinne, and the haire is a finger thick."

While De Sota was remaining at the town of Chiaha (now Rome, Ga.) in 1540, he detached Villabos and Silvera—two fear-less soldiers—to explore the mountains to the north for gold. They returned July 9th, having found no gold, but mines of a highly colored copper used by the natives, who also gave them a hide which they supposed once covered a tremendous animal partaking of the qualities of the ox and the sheep, and much used by the natives, "which because the countrie was cold were very profitable, and served for coverlets because they were very soft and wooled like sheep. Not farre from thence towards the north were many oxen." Subsequently when at Pacaha—west of the Mississippi—De Sota sent thirty horsemen northward to explore the country. At a poor town at which they stopped, they were informed that the country above was very cold and there were such store of oxen that they could keep no maize for them, but that the Indians lived upon their flesh.

Alvar Nunez Cabeza, the treasurer of the ill-fated Narvaez expedition, wandering from Florida to Mexico with his three companions—1528 to 1532—saw immense herds of buffalo, and from his account of them in his Neufragios received the appendix to his name "de vaca" (of the cattle). In speaking of the section west of the Mississippi, he says: "In that country there were grey and black cows, with long hair, no bigger than those of Barbary, and their flesh coarser than Spanish beef."

In 1540, Coronado, in his celebrated expedition, first heard of buffalo at Cibola (Zuni), and says that the people: "travel eight days' journey, into certain plains lying towards the North sea. In this country are certain skins well dressed, and they dress them and paint them where they kill their oxen, for so they say themselves." He also saw an Indian there from another province who had a buffalo painted on his breast, and his chronicler, Castaneda, speaking of the hides, says they are "covered with a frizzled hair resembling wool." After the expedition left Cicuic (Pecos) he says: "All that way and the plains are as full of crooked backed oxen as the Mountain Serena in Spain is of sheep, but there is no people but such as keep those cattle."

Gomara gives the following description of the buffalo as seen by Coronado and his army: "Those oxen are of the bigness and color of our bulls, but their horns are not as great. They have a great bunch upon their fore shoulders, and more hair upon their fore part than on their hinder part, and it is like wool. They have great tufts of hair hanging down their foreheads, and it seemeth they have beards, because of the great store of hair hanging down at their chins and throats. The males have very long tails, and a great knob or flock at the end, so that in some respects they resemble the lion and in some others the camel. They push with their horns, they run, they overtake and kill a horse when they are in their rage and anger. Finally it is a fierce beast of countenance and form of body. The horses fled from them, either because of their deformed shape or else because they had never seen them before. Their masters have no other riches or substance; of them they eat, they drink, they apparel, they shoe themselves; and of their hides they make many things, as houses, shoes, apparel and ropes; of their bones they make bodkins; of their sinews and hair, thread; of their horns, maws and bladders, vessels; of their dung, fire; and of their calf skins, budgets wherein they draw and keep water. To be short they make so many things of them as they have need of, or as may suffice them in the use of this life."

In 1585 Espejo, returning from his exploration of Northern New Spain, says that he traveled down a river "called Rio de las Vacas (that is to say the River of Oxen, now the Pecos, in Texas) in respect of the great multitude of oxen or kine that fed upon the banks thereof, by the which they travelled for the space of 120 leagues—still meeting with store of the said cattell."

Sir Humphrey Gilbert, whose voyages commenced in 1583, says there are in Newfoundland, "buttolfes, or a beast, it seemeth by the tract and foot very large in maner of an oxe," and in a work published by Hakluyt in London (1589), it is stated that in the island of Newfoundland were found "mightie beastes like to camels in greatnesse and their feete were cloven. I did see them farre off, not able to discerne them perfectly, but their steps shewed that their feete were cloven and bigger than the feete of camels. I suppose them to be a kind of Buffes, which I read to bee in the countreys adjacent, and very many in the forine land."

Another author, Purchas, says that as early as 1613 the adventurers in Virginia discovered a "slow kinde of cattel as bigge as kine, which were good meate."

A work published at Amsterdam in 1637, by Thomas Morton, called "New English Canaan," contains the following: "The Indians have also made description of great heards of well grown beasts, that live about the parts of this lake (Erocoise) such as the christian world (until this discovery) hath not bin made acquainted with. These beasts are of the bigness of a cowe, their flesh being very good foode, their hide good leather; their fleeces very useful, being a kind of woole, as fine almost as the woole of the beaver, and the salvages do make garments thereof. It is tenne yeares since first the relation of these things came to the eares of the English."

Joliet and Marquette, descending the Mississippi in 1673, saw immense herds of buffalo, and the latter thus discourses of them: "We call them wild cattle, because they are like our domestic cattle, they are not longer, but almost as big again, and more corpulent; our men having killed one, three of us had considererable trouble in moving it. The head is very large, the forehead flat and a foot and a-half broad between the horns, which are exactly like our cattle, except that they are black and much larger. Under the neck there is a kind of large crop hanging down, and on the back a pretty high hump. The whole head, the neck, and part of the shoulders, are covered with a great mane like a horses; it is at least a foot long, which renders them hideous, and falling over their eyes prevents their seeing before them. The rest of the body is covered with a coarse curly hair like the wool of our sheep, but much stronger and thicker. It falls in summer, and the skin is then as soft as velvet. At this time the Indians employ the skins to make beautiful robes, which they paint of various colors."

The first engraving of the buffalo appeared in the first edition of Father Hennepin's travels.

Jontel in 1685 saw buffalo at Bay St. Bernards, and the same year La Salle's party found them on a river in Texas which they named La Vaca, from that circumstance Charlevoix in one part of his works calls them "Illinois cattle." In 1756 some of those who settled in the Abbeville district of South Carolina found buffalo there, and in 1774 Bernard Roman speaks of them as a "benefit of nature conferred on Florida." In 1769 Daniel Boone and Finley found them in small numbers in the valleys near the Cumberland mountains, but came across a large herd in a valley at the west foot of the Alleghany mountains. Boone remarked to his companion: "Job of Uz had not larger droves of cattle than we." Father Venezas does not include the buffalo among the animals of California, neither Harmon nor Mackenzie speak of them as being in New Caledonia, and Du Pratz says they did not exist in Lower Louisiana.

In the last century the trade in buffalo wool became brisk, and numerous factories were established for its manufacture into cloth.

The buffalo roamed in small herds all over the country before the advent of the white man, but only on the plains were those immense herds, so often described, ever seen. The prairie was its favorite resort. The railroads and settlements have, however, broken these herds into small bodies, and the unrestrained slaughter of buffalo in the past few years has so reduced their numbers that their extinction is a question of a very short time.

Buffalo make good tractable work cattle when caught young, and the *Bois Brules* frequently use them as such.

White buffalo have frequently been seen and killed. All the Indian tribes regard them as "big medicine" but they have different superstitions regarding them. For instance, Catlin, the painter, while among the Mandans in 1832, saw a white buffalo robe erected on a pole in their village as a sacrifice to the great spirit. It had been purchased from the Blackfeet, who killed the buffalo, for eight horses and a quantity of goods. On the other hand the Comanches believe it very dangerous to see a white buffalo. In 1869 I saw a young Comanche, who had seen a white buffalo, return to his camp almost dead with fear. He was taken into his tent, the medicine men were sent for, and they smoked him and kept up incantations over him day and night for a week. When he came out he believed that he had a very narrow escape from death. In 1869 a white buffalo was killed by a white man on the north fork of the Red river, I. T., and the hide presented to Gen. Grierson. He desired to have it dressed to preserve it, but failed to get any Indian to undertake the task for a long time. At last he prevailed on a Comanche chief named "Horseback" to have the operation performed. "Horseback" selected one of his squaws, had the "medicine men" of his band go through various ceremonies over her to preserve her life, and then placed her in a teepee some distance from his camp, where the hide was taken to her by a soldier and brought away by him when dressed. No other Indian would look at the hide, much less touch it. Her food was left for her at some distance from her teepee, and when the robe was dressed, "medicine" ceremonies were held over her before she was allowed to rejoin the camp. I twitted "Horseback" about the fear of the robe, calling his attention to the fact that no harm befell any of the white men who handled the robe, but he answered that such might be the case, but what was "bad medicine" for a Comanche might be "good medicine" for a white man, and *vice versa.* He proposed to take no risks in the matter.

A white buffalo (stuffed) was on exhibition at the Centennial Exposition, the property of R. M. Wright, of Kansas, and it is a pity that it was not secured by the Smithsonian or some other institution for preservation.

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EDITORS' TABLE.

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

—— The tariff laws of the United States are in some respects a direct tax on intellectual progress, and although it is not unlikely that this result is entirely due to oversight on the part of the framers of those laws, the consequences are none the less injurious. Some of our contemporaries doubtless remember the difficulties experienced by Alvan Clark & Sons, of Cambridge, in procuring unwrought optical glass, for use in building the telescopes for which their house is so highly esteemed. The high tariff on these rough discs operated as a prohibition to the manufacture of the optical instruments to which they are necessary. This result was probably not anticipated by our legislators. After prolonged negotiations, special dispensations from the Treasury Department have permitted the discs to pass free if for schools, colleges or academies, otherwise a duty of 10 p. c. is exacted.

The law with regard to "specimens of Natural History," that is, those relating to botany, zoölogy, palæontology, geology and mineralogy, imposes a heavy duty on them when they are intended for sale, or are not designed for exhibition in a public institution. As the greater number of specimens of this kind are obtained by persons who depend on their sale for reïmbursement, it is evident that students in this country must pay the tax, or go without them. The actual result is, that students and institutions being mostly poor, do not purchase, and sellers must pocket the loss. So well known has this become, that such objects nearly all now go to Europe, to the impoverishment of science here, and the great enlargement of the facilities for study abroad. In spite of considerable self-praise, the poverty of most of our museums is marked, and in proportion to our population and resources, their number is probably smaller than in any other civilized nation.

Precisely why congressmen should wish to tax bottled frogs and snakes we cannot clearly understand. It is true that these animals have a market value as food for man, but our government does not tax foreign meat or bread-stuffs. Nor has any one of our legislators announced his intention of fencing in a tract to be used as pasture for boas and anacondas, for it is generally believed that the breeding of these animals, though profitable, is not practicable in this country, owing to the antipathy to them of certain American citizens of foreign birth. Nor is there any fear of a dangerous foreign competition with their natural production here; for although we were once informed by a Virginian mountaineer, that both "the Bowling constrictor, and the Africanstrictor" were found in his neighborhood, we afterwards learned that he had been led into error by confiding too implicitly in the representations of a traveling showman.

We may, however, be wrong in all this, for we have lately been taught by our rulers that a live hippopotamoid is merchandise. A specimen of the small hippopotamus-like *Chœropsis liberiensis*, having been imported from West Africa by Mr. Forepaugh for the instruction of American citizens, it became necessary to restrain this pandering to a corrupt taste, by imposing the duty *ad valorem*. It was hoped by the officers of the United States, that the beast had been obtained on the east coast of Africa, so that they might be enabled to levy 30 p. c. duty. But Mr. Forepaugh unpatriotically called on Professor Leidy, who swore (and so do we) that the animal was derived from the west coast; so the Government could only collect 20 p. c.! Dr. Leidy also swore (and so do we) that it was a *Chœropsis* and not a *Hippopotamus*, but Mr. Forepaugh could not get any reduction on this account. And this in spite of the argument urged with much force, that although the Hippopotamus manufactories along the Delaware and Mississippi would certainly be ruined by the introduction into the country of a *Hippopotamus* free of duty, there had not been as yet a single establishment for the production of *Chœropses* set up within the limits of the United States.

We had almost overlooked one remarkable effect of the tariff on collections of foreign fossils. The home industry in fossil bones has been so stimulated, that like our cotton goods in China, and our cutlery in Australia and Sheffield, our fossils are assuming a front rank in the markets of the old world, once the sole producers. And from still another stand-point, if some unwise legislator does not remove the duty all too soon, we shall undoubtedly have a greater home production of fossils in all that relates to knowledge of the laws of nature than any nation on the globe.

not excepting the Indian and the negro. And we shall ultimately have the proud satisfaction of engraving on the tomb of science in this country, "*De mortuis nil nisi bonum.*"

—— The Governor of Pennsylvania refers to the Geological Survey of the State, in his late message to the Legislature, in the following language:

"The Second Geological Survey of the State is progressing as fast as the appropriations will permit. This is a work which, if not well done, should not be done at all. It must possess the utmost scientific accuracy. Its treatment of soils and minerals, their location and distribution, must be the result of painstaking work, done on the ground. Its surveys and alignments must show the actual facts, and be made from actual measurements. This is precisely the way in which this great and important work is being done. It is in the hands of a board who understand fully the value of the duty in hand, under the superintendence, as State Geologist, of J. Peter Lesley, Esq., whose attainments and qualifications are unquestioned. So far forty-four reports of this work have been published, and sixteen reports are in preparation. These reports have justly attracted the highest attention everywhere. Forty-two counties have been surveyed in full, eighteen in part, and seven not at all. These seven are Columbia, Luzerne, Lackawanna, Pike, Schuylkill, Berks, and Carbon. They embrace the anthracite coal region of the State, and have been reserved that the work upon them may be made continuous and exhaustive. In a scientific and commercial point of view the surveys to be done in them will possess the highest value. It will be expedient to make the appropriations to continue this work in accordance with the views of the board controlling the Second Geological Survey."

The recommendations of the Governor as thus expressed, are doubtless seconded by every friend of intellectual and material progress in the Commonwealth. The Geological Survey of Pennsylvania has added, and will add important contributions to the knowledge of the laws of nature as exhibited in all the aspects of creation. Such are the chemical conditions of the primitive world; the forces which have distorted its crust; and the experiences and progress of ever present life, vegetable and animal, under these laws. It is of great importance to the educational interests of the country that the State governments should place before their people statements of the history of the regions which they represent. Such histories express in their highest aspect, the laws of life; and to the importance of a knowledge of these, no one can be insensible. The economic side of a geological survey is, however, more generally appreciated, for it is evident that an inventory of her possessions is most desirable for a State to possess. It is especially so to a State like Pennsylvania, where so large a part of the population is directly or indirectly dependent on the contents of the rock strata for their livelihood.

RECENT LITERATURE.

REPORT OF THE COMMISSIONER OF FISH AND FISHERIES FOR 1878.[1]—This bulky volume is a valuable contribution to applied zoölogy, a subject in which the United States is, happily, nearly if not quite on a par with France or Germany, if not excelling those countries. The times are now ripe for the people of this country to receive from scientific men the fruits of the application of the scientific knowledge which has been stored up in museums and libraries; and fortunately this process, as seen by the work of the U. S. Fish Commission, in the end aids in the true development of science. From "skin and bone" zoölogy, preserved fish, trays of labeled fish-bones and "species work," to the study of the habits of fishes, their distribution in geographical extension and in vertical range, their relations to one another, and to the world of invertebrate animals on which they rely for subsistence, their embryology, their relations to the physics of the sea—these are questions of abstruse and philosophic import, as well as of purely practical, economic moment. Thus in fish-breeding as in star-gazing or gas-making, the solution of the deepest problems of science go hand in hand with the commonest, most trivial operations and needs of our everyday life. And human life has now become so composite and differentiated, our population is growing so dense, and the means of living for the masses so much more precarious, that what is now wasted must eventually be converted into wealth, and the practical application of science must be brought to bear in the solution of these economic problems.

The report before us is a due commingling of purely scientific research with practical essays on fish-breeding and fisheries. The discovery of new food-fishes; the best and speediest means of propagating and restocking our coast and inland waters, the mechanical contrivances, nets and apparatus for hatching, and similar subjects, with voluminous extracts from, and translations of, European articles, are presented in this as in former volumes. With such practical matter is combined some excellent work in pure zoölogy, viz.: a report on the marine Isopoda of New England and adjacent waters, by Oscar Harger, with thirteen well executed plates; and a report on the Pycnogonida of New England and adjacent waters, by Edmund B. Wilson, with seven plates. These papers will be noticed elsewhere in this journal.

Professor Baird concludes his report with the suggestion that as a possible result of the application of steam to fish-hatching apparatus, we may be able to so multiply the number of our cod, mackerel, herring and halibut, "as to obviate the necessity in the

[1] *United States Commission of Fish and Fisheries.* Part VI. Report of the Commissioner for 1878. A. Inquiry into the Decrease of Food-fishes. B. The Propagation of Food-fishes in the waters of the United States. Washington, 1880. 8vo, pp. 988.

future of asking a participation in the inshore fisheries of the British provinces, and thus enable us to dispense with fishery treaties or fishery relations of any kind with the British or other governments."

HORN'S SYNOPSIS OF THE BURYING BEETLES OF THE UNITED STATES.[1]—Although this essay is modestly called a "Synopsis," it is much more than that, as the characters of the family and its sub-divisions, of every species and genus, are given with sufficient fullness, and moreover the common species which were described years ago are re-described. This is an excellent feature, because in synopses of different groups of insects it is usually the case that the species already described are mentioned only by name, and to the beginner it is difficult to learn what are really the common species briefly and imperfectly described in the often inaccessible works of Linnæus, Fabricius, Olivier, Dejean and others. Another excellent feature of the essay is that the author has himself given excellent figures in outline of all known genera (with few exceptions), nearly all of which have been drawn by himself from nature.

Dr Horn has made some changes in the limits of the group, and all the foreign genera have been included in the study and mentioned in the generic tables, though not described. The family is an interesting one, as it includes the true burying beetles, and also a good proportion of the cave beetle of Europe and America. It is interesting to trace, as Dr. Horn has done, the relationship of our *Adelops* of the Mammoth Cave to the out-of-door forms, and to see, a point not however noticed by the author, that Adelops simply differs from its out-of-door allies of the genus Ptomaphagus in the small eyes, and longer, slenderer antennæ, and other slight characters, so as to lead our author to say that Adelops "is closely allied to Ptomaphagus and I am in doubt whether it should be retained as distinct." We should reason from this that *Adelops hirtus* was originally derived from some out-of-door species of Ptomaphagus which had got into the cave and been modified by its cave-life into its present form. The main results of a cave life are the impairment or actual loss of the eyes, and to compensate for this the elongation of the antennæ, which probably renders the sense of touch, and possibly of smell, more acute. This also adds another to the cases which almost demonstrate that all the cave animals have originated from out-of-door forms.

In conclusion we may express the hope that the recent labors of Drs. LeConte and Horn, may enable them ere many years to prepare a compact manual of our United States Coleoptera, a consummation most devoutly to be wished. With fair compendiums

[1] Synopsis of the Silphidæ of the United States with reference to the genera of other countries. By GEO. H. HORN, M.D. From the transactions of the American Entomological Society. Philadelphia, 1880. 8°, pp. 219–320. 3 plates.

of our native bees, wasps, flies, beetles, butterflies and moths, bugs and grasshoppers and Neuroptera, an immense impetus would be given to the study of entomology As it is, we fear that the twentieth century will be far advanced before these desirable works will be published.

ROBINSON'S FLORA OF ESSEX COUNTY, MASSACHUSETTS.[1]—Essex county enjoys the distinction of being at an early date one of the botanical centers of the United States, as it was the home of Dr. Manasseh Cutler, Dr. George Osgood, Dr. Andrew Nichols, Dr. Charles Pickering and, more particularly, of William Oakes, to whose memory the genus *Oakesia* has recently been dedicated by Mr. Sereno Watson. The names also of Rev. John L. Russell and Mr. Geo. D. Phippen, Mr. S. B. Buttick, and of others, should be mentioned; while Mr. C. M. Tracy, in his Flora of Lynn, was the first to publish a list of Essex county plants. These and other facts are related by our author in the historical introduction to his Flora. It appears that originally almost the only extended collection of dried Essex county plants were those of the late Mr. Oakes, but the list before us is based upon the herbarium recently collected by Mr. Robinson, and nearly all of which is represented in that of the Peabody Academy of Science, at Salem. The notes under the specific names are quite full and interesting as regards the flowering plants; the enumeration of mosses and thallophytes, in which the author was assisted by other botanists, is less complete. We would like to have seen a more detailed bibliograpy, *i. e.*, the titles given in full, with complete references to articles by the earlier botanists, of which the titles and dates are not always given; only the name, without the date, of the magazines or transactions containing them. But this is a minor blemish. The undertaking has been well carried out, the volume is a handsome one, and it will be a *vade mecum* to the herbalist of eastern New England.

REPORT OF THE COMMITTEE OF THE FRANKLIN INSTITUTE ON ANALYSES OF INKS.—A committee of the Franklin Institute was appointed by a vote of that body at its November meeting, for the purpose of examining into the truth of certain statements made and the value of certain tests proposed for the detection of iron in inks. The object of the appointment was stated to be that during the interval of time which should elapse between now and the legal remedy of the expert abuse in court, an extra judicial court might criticise all statements professing to be scientific and the fear of reversal before their peers might be an additional security for the value of expert statements.

The committee resolves "that inasmuch as the methods for the "detection of iron in inks and for the identification of inks are "described in numerous and well-known works on chemistry; "and inasmuch as the chemical expert testimony in the Whittaker

[1] The Flora of Essex county, Massachusetts. JOHN ROBINSON, Salem. Essex Institute, 1880. 8° pp. 200.

"will case contains nothing new of scientific interest, your committee beg to be relieved of further consideration of the subject. "Resolved, That we call the attention of the Franklin Institute to "the numerous objections to which expert investigations are "open, when undertaken as at present by parties securing the services and interested in the decision of the court, and we earnestly recommend that the Franklin Institute takes such action "that the change from the present plan may become a subject of "legal enactment." The signers of this remarkable production are Dr. W. H. Greene, Dr. Geo. A. Koenig, Dr. Wm. H. Wahl, Mr. Moody, Mr. Pemberton, Sr., and Dr. Isaac Norris.

The humorous points of this report cannot be better appreciated than by comparing it with the statements of some of those experts whose testimony the committee was to examine. Compare the first "inasmuch" with this by the ex-President of the Franklin Institute, Prof. R. E. Rogers: "I don't recall in any of our chemical books a direction for examining writing for iron. I do not know a single authority" (Wed., April 14, 1880, 54th day, p. 6469). Dr. Genth says: "I do not believe anybody has ever made any experiment in that direction" (*i. e.*, the conditions under which potassium ferrocyanide and sulphuric acid react on each other). The second "inasmuch" is equally opposed to the testimony.

Committee's Report.—"And inasmuch as the chemical expert testimony in the Whittaker Will case contains nothing new of scientific interest—."

Dr. Rogers.—"It has been entirely overlooked by the writers of the text books that these reagents" (*i. e.*, potassium ferrocyanide and potassium sulphocyanide.) "are not sufficiently refined for the nice determination of the presence or absence of iron" (p. 6420).

—"There may be writing which contains iron that * * tested for iron by the method which has been adopted will fail to show the presence of iron" (6430).

—The "fire test" devised by Dr. Rogers for determining iron in inks and pronounced the "most rigorous" (p. 6438-9).

Mr. Johnson.—"Professor, is the fire test stated in the books?" "No, sir." "Then it is a result from your own original experimenting?" "Yes, sir" (p. 6470).

—*Mr. Johnson.*—"But they do see that there is a blue, the result of the mixture?"

Dr. Rogers.—"Of what?"

Mr. Johnson.—"Of the sulphuric acid and ferrocyanide of potassium."

Dr. Rogers.—"No, they do not. I don't think such a thing has been observed generally."

Mr. J.—"When you put them in one bottle, how can you avoid it?"

Dr. Rogers.—"They are not put in one bottle."

Mr. J.—"Suppose they are."

Dr. R.—"I have never known them to be put in one bottle, except instances in which I have done it" (p. 6497).

It will sufficiently appear from the above that either the distinguished representatives of chemistry in the University of Pennsylvania and the Jefferson College are mistaken or else great chemical discoveries have been the result of the Whittaker will trial. The advice of the committee does not seem to be *apropos* to anything; as its reason for not undertaking the duty assigned to it, viz.: that the duty would not be profitable, seems to be gratuitous. The whole report is a very good illustration of "how not to do it."—*Persifor Frazer.*

OUTLINES OF LINGUISTIC SCIENCE.[1]—In what has appeared of the second volume of his "outline of linguistic science," the celebrated Austrian linguist has given to the world a series of short, but lucid sketches of the languages of Eastern Siberia, not belonging to the Ural-Altaic family; of Ale-ut, Eskimo and also of the whole Malay-Polynesian family scattered over the whole Pacific ocean. The languages of Western and Southern Africa was disposed of in the first volume, and in one of the next numbers the author will reach the American languages.

MOLINA'S DICTIONARY OF THE AZTEC LANGUAGE.[2]—This work is a most praiseworthy republication of the second edition of Molina (1571), the only copious dictionary which exists on the Aztec language. To students, who were almost discouraged by the high price of the original, this republication is now offered at a moderate figure (50 marks in Leipzig, unbound) and will enable them to study the sonorous Aztec tongue from the best authority in existence. The volume contains over 50,000 terms.

RECENT BOOKS AND PAMPHLETS.—Sur l'uniformité de la Nomenclature Géologique dans tous les pays, en ce qui regarde les Terrains et les Etages. (Ext. du Compte Rendu Sténographique du Congrès International de Géologique, 1878.) Par M. Stéphanesco. 8vo, pp. 4, 1880. From the author.

Some Copper Deposits of Carroll county, Maryland. By Persifor Frazer. 8vo, pp. 8. Maps 1, 1880. From the author.

Extraits de Géologique pour les années 1877 et 1878. (Ext. des Ann. des Mines, 1880.) Par MM. Delesse et de Lapparent. 8vo, pp. 242. Paris, 1880. From the authors.

The Food of Fishes. (From Bull. No. 3, Ill. State Lab. Nat. Hist., November, 1880.) By S. A. Forbes. 8vo, pp. 61. From the author.

Annual Report of the Secretary of the Interior on the operations of the department for the year ending June 30, 1880. 8vo, pp. 81. From the department.

Drug Adulterations. By S. V. Clevenger. (From the Druggist for December, 1880.) pp. 7. From the author.

Cerebral Anatomy Simplified by Comparative Anatomy Studies by S. V. Clevenger, (From the Chicago Med. Journ. and Examiner for November, 1880.) 8vo, pp. 9. From the author.

Erster Nachtrag zum Katalog der herpetologischen Sammlung des Basler Museums. Von F. Müller. 8vo, pp. 49, pl. 1. 1880. From the author.

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[1] *Dr. Friedr. Müller, Grundriss der Sprachwissenschaft.* Vol. II, No. 1[a], 2[a]. Wien. 1880. 8°. A. Flölder, publisher.

[2] Vocabulario de la lengua Mexicana, compuesto por el P. Fr. *Alonso de Molina;* publicado de nuevo por Julio Platzmann. Edicion facso'milaria. Leipzig, B. G. Teubner. 1880. 4°. Parte I. Castell.-Mexic. 121 double pages. Parte II. Mexic.-Castell. 162 double pages, of two columns each.

Expedition Geológica por la Provincia de Toledo en 1877, por D. de Cortázar. Madrid. 8vo, pp. 7. Maps 1. From the author.

Memoria acerca de la Exposicion Universal de Filadelfia en 1876, por D. de Cortázar, Madrid. 8vo, pp. 420, 1 map. From the author.

United States Commission of Fish and Fisheries. Report for 1878. 8vo, pp. 988, plates 36. Washington, 1880. From the commissioner.

Observations Générales sur la Famille des Scincoidiens por M. Bocourt. (Ext. de la Zool. de Mex., 3e partie.) Folio. pp. 7, pls. 2. From the author.

A structural Feature, hitherto unknown among Echinodermata, found in Deep Sea Ophiuraus. By Theodore Lyman. (From Anniv. Mem. Boston Soc. Nat. Hist.) 4to, pp. 12, pls. 2. Boston, 1880. From the author.

Beiträge zur Paläontologie von Österreich-Ungarn und den Angrenzenden Gebieten. Herausgegeben von E. v. Mojsisovics und M. Neumayr. 4to, pp. 71, pls. 8. From the editors.

Illustrations of Nests and Eggs of Birds of the United States, with text. By Thomas G. Gentry. 4to, pls. 3 and 4. Philadelphia, 1880–'81. From the author.

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GENERAL NOTES.

BOTANY.[1]

The Fungi which produce Mildew on Cotton Goods.—In a recent English work upon "Sizing and Mildew in Cotton Goods," by G. E. Davis, Charles Dreyfus and Philip Holland, the following fungi are enumerated as found growing on cotton goods and in analogous situations, viz: *Stachybotrys lobulata*, *Stachybotrys atra*, *Penicillium sitophilum*, *Myxotrichum deflexum*, *Polyactis fascicularis*, *Sporocybe alternata*, *Rhopalomyces pallidus*, *Papulaspora sepedonioides*, *Acremonium alternatum*, *Ascophora mucedo*, *Penicillium chartarum*, *Penicillium crustaceum*, *Aspergillus glaucus*, *Aspergillus roseus*, *Periconia glaucocephala*, *Cladosporium herbarum*, *Chætomium chartarum*, *Ascotricha chartarum*, *Orbicula cyclospora*, *Ailographum maculare*, *Diplodia cowdellii*, *Sphæropsis* sp., *Ascobolus saccharinus*, *Typhula gyrans*, *Arcyria ochroleuca*, *Perisporium vulgare*. Of these the authors say, "the above have all been found on decaying vegetable fibers, the most common being *Cladosporium herbarum*, *Penicillium crustaceum*, and Sporocybe, with two species of Aspergillus. The fungus giving a reddish hue to stale rice paste is known as *Papulaspora sepedonioides*, whilst *Diplodia cowdellii* is the cause of black spots on damp cotton. We have noticed others in our experiments, notably *Macrosporium cheiranthi*, *Rhinotrichum lanosum*, *Myxotrichum chartarum*, *Mucor phycomyces* and *Mucor mucedo*, but we hesitate in placing these species as being nominally found in cotton goods."

Further on the authors say, "The colored stain which first attracts the eye when examining a specimen of mildewed cloth, is due possibly to the mycelium, or it may arise from the fructification of a fungus; or, again, organic colors produced by the decomposition of a nitrogenous substance, or carbo-hydrate in the matrix may be the cause of it. When nitrogenous substances

[1] Edited by Prof. C. E. Bessey, Ames, Iowa.

are present in a pabulum, though in small quantity only, the mildew usually commences to be visible to the naked eye as minute yellow spots. These, as we have just said, may be caused by the growth of the mycelium, which in providing nourishment for itself and for the subsequent fructification of the fungus, brings about a decomposition of the nitrogenous materials, and gives rise to crenic and other organic acids. At a more advanced stage, humic and ulmic acids are produced, the fiber of the cloth becoming at the same time perceptibly more tender. It has been said that mildew may exist on the sizing only of a fabric. We are inclined to doubt this, for in our experience the mycelial threads have never been confined to the surface size alone, but could always be traced ramifying amongst the cotton filaments. If the size alone of a cloth were smitten with mildew, the cloth itself would not be tendered, unless the acids we have mentioned were a sufficient cause, which is not so. We believe it impossible for mildew to be present in such amount as to be clearly visible to the eye without a penetration of the mycelium to the textile substratum, and should expect a suitable magnification and illumination of the object to reveal the fact."

As to the colors of mildews, according to the authors, yellow patches on cloth are mostly due to the presence of crenic acid, although very rarely they proceed directly from the fungus, *Penicillium sitophilum;* green mildew is nearly always due to the fructification of *Penicillium crustaceum;* and dark-green or greenish-gray mildew is owing to the fructification of a Penicillium or Aspergillus, or to the mycelium of a species of the Dematiei. Brown mildew may be due to the presence of apocrenic acid, or of one or more of many fungi. Red patches appear to be due to fungi; those mentioned by the authors being a species of *Epicoccum*, *Aspergillus roseus*, and *Papulaspora sepedonioides.*

Allen's Characeæ Americanæ Exsiccatæ.—We have had the pleasure of examining Part 1 of this important distribution of curious and little known plants. It includes three species of Nitella, and seven species and varieties of Chara. The specimens are of generous size, and are in excellent condition for study. The more interesting species are *Nitella intermedia*, a new one, described by Nordstedt; *N. megacarpa*, a new species now first described as such by Allen; *Chara sejuncta* A. Br., *C. gymnopus* A. Br., var. *Michauxii* A. Br., a gigantic species, and *C. hydropitys* A. Br., var. *septentrionalis.* The variety last named is described by Nordstedt, and is the same plant which Dr. Halsted described as a new species under the name of *C. Robbinsii* in the Proceedings of the Boston Society of Natural History, xx; 1879. *Nitella megacarpa* Allen, is the same as *N. intricata* Ag., in Halsted's paper; it is of very large size, and compared with the diminutive *N. tenuissima* is a giant indeed.

The publication of sets of specimens like these cannot fail to stimulate a search for these interesting plants by American botanists, and it is to be hoped that during the coming season all collectors who can do so will render what service they can by gathering abundant specimens and forwarding them to Dr. Allen, at 10 East 36th street, New York. There are few localities in which half a dozen or more species cannot be found. We are informed that the author has already material for forty or fifty species or clearly marked varieties, and is confident that the number will eventually reach seventy-five.—*C. E. B.*

THE PEPPERIDGE TREE IN MAINE.—Our attention has been called by Professor G. H. Stone of Kent's Hill, Maine, to the fact that the pepperidge or tupelo *(Nyssa multiflora)* is a native of Maine, although neither Gray nor Wood so state in their manuals. It is given as one of the trees of the State in the "Portland Catalogue of Maine Plants, 1867," and according to Dr. Goodale, was found at Winthrop and Waterville, by the late Dr. Holmes. Professor Stone sends specimens from Kent's Hill, Kennebec county. The importance of this note lies in the fact that Vasey, in his "Catalogue of the Forest Trees of the United States," gives its range as "from Massachusetts to Illinois, and Southward," while Sargent, in his preliminary "Catalogue of the Forest Trees of North America," gives it as from "West Milton, Vermont, South to Florida; West to Michigan, Missouri and Arkansas."—*C. E. B.*

HISTOLOGY OF THE PUMPKIN STEM.—Professor J. C. Arthur has been studying the stem of the pumpkin, and in an article in the *Botanical Gazette* sums up the tissues as follows:

Epidermal System:
- Epidermis.
- Stomata.
- Hairs.

Fundamental System:
- Interfascicular parenchyma.
- Hypodemia.
  - Cortical wood.
  - Cortical parenchyma.
  - Collenchyma.

Fibro-vascular System:
- (Cambium.)
- Phloem.
  - Sieve-tubes.
  - Phloem parenchyma.
- Xylem.
  - Vessels.
    - Annular.
    - Spiral.
    - Reticulated.
    - Scalariform.
    - Pitted.
  - Wood parenchyma.

Professor Arthur directs attention to the value of the pumpkin-stem for use in the instruction of classes in the Botanical Laboratory, furnishing, as it does, so many examples of the tissues of the higher plants. We can also testify to its value, having used it for many years for the purpose recommended. We always secure every autumn several feet of stems, which we cut up and preserve in jars of alcohol, for future use in the laboratory.

FERTILIZATION OF AQUILEGIA.—The species of Aquilegia to which I referred, and on which Mr. Trelease comments, have nectaries of 40 millimetres long; while 21 is the longest bees-tongue as he believes. But the species I noted have curved nectaries, which it would probably try the patience of a busy bee to course, even if the tongue were long enough. Moreover if my observations are worth any thing, Aquilegias hereabouts are cross-fertilized by pollen-hunting insects. It may be that honey bearers cross-fertilize them sometimes, for one man cannot see everything; but I have never seen a case. If this be the fact, as I believe it to be, the arrangement of the nectarium in the case is superfluous.—*Thomas Meehan.*

THE EDITOR of this department has in preparation for the NATURALIST a sketch of the Progress of Botany in the United States in the year 1880, and solicits copies of papers and other publications made during the year, together with such other information as will make the account as full and accurate as possible.

BOTANICAL NOTES.—A good many years ago DeBary suggested the animal nature of the slime moulds (Myxomycetes), and was very severely criticised for doing so, the naturalists of that day feeling bound to maintain the old dogma of the absolute distinctness of the animal and vegetable kingdoms. Now, however, any one at all familiar with the Monera and the slime moulds cannot fail to see the remarkable similarity between the organisms which, on the one hand, are called animals, and on the other, plants. This has led W. Saville Kent, in his recently published work on "Infusoria," to take strong ground in favor of regarding them as animals. M. C. Cooke, in *Grevillea* for December, rather impatiently takes the learned author to task for his boldness. After all, what is the use of quarreling over a matter like this? The position of the slime moulds in the great kingdom of life, is the same whether we draw our imaginary bisecting line on this or that side of them.—— The temper of the discussion of the foregoing question is much like that which (on one side at least), characterizes the articles on the several theories as to the nature of Lichens. A good illustration of this occurs in the same number of *Grevillea*, in a letter from Dr. Minks, the propounder of the new doctrine of the intra-hyphal origin of the gonidia of lichens. Dr. Minks attempts to set right Mr. Phillips' somewhat defective translation of the former's paper on Microgonidia in *Révue Mycologique*, and, it must be confessed, scarcely betters the matter. At some future time a summary of Dr. Minks' doctrine will be given in these pages.—— Charles B. Plowright, in *Grevillea*, describes the method of spore diffusion in a species of morel (*Morchella gigas*). Specimens gathered and laid upon boards in a room, were observed in the slanting rays of the setting sun to be surrounded by a cloud three or four inches deep on all sides. This proved to be due to the myriads of ascospores which were elastically escaping from the asci.—— In the December *Journal of Botany*, there appears an interesting account of George

Murray's experiments undertaken to determine the method of the diffusion of the conidia of the potato disease *(Peronospora infestans).* Microscopic slides coated with glycerine were exposed on the lee side of an infested potato field, and carefully examined at intervals of from ten to twelve hours, *i. e.*, at 9 A. M. and 7 P. M. No conidia were caught during the night, but upon the twenty-eight square inches of surface exposed during the day, there were caught in the first day 15 conidia; in the second, 17; in the third, 27; in the fourth, 4; in the fifth, 9. Considering the small amount of surface exposed by the slides, and the fact that only about two per cent. of the potato plants in the field were diseased, the number of conidia caught is very large.—— Henry M. Douglas, of South Richland, N. Y., has undertaken to translate the successive numbers of the *Botanische Zeitung*, as they appear.—— Queen & Co., of Philadelphia, have prepared a series of twenty-four slides of microscopical specimens illustrating many points in the histology of the higher plants. They are neatly mounted and will be useful to many teachers and students.—— The *American Monthly Microscopical Journal* has, during the past year, contained many valuable botanical articles; among these may be mentioned several Notes on Fresh-water Algæ, Double-staining of Vegetable Tissues, The Salmon Disease and its Cause, besides many upon Diatoms. The microscope is now indispensable to the botanist, and it is encouraging to find that microscopical journals are beginning to make themselves useful to him also.—— *Science* has now a botanical department.—— W. P. Schimper's herbarium (of mosses) has been purchased by the Kew Herbarium.—— In Nos. 46—50. of *Botanische Zeitung*, Goebel publishes an interesting paper on the Morphology and Physiology of Leaves, accompanied by a plate with many figures.—— In No. 50 of the same journal Strasburger's paper on cells with several nuclei, and some points in the embryogeny of Lupinus, promises to be of considerable value. —— A new and thoroughly revised edition of Rabenhorst's Cryptogamic Flora of Germany, Austria and Switzerland is announced. Of the first volume (Fungi), the first part is now ready.

ZOÖLOGY.

Description of a Hermaphroditic Phyllopod Crustacean (Eubranchipus).—The single specimen of *Eubranchipus vernalis* here described was found in January, 1880, in a small, isolated pool, near Maspeth, L. I., living in company with a great number of a pale, transparent race of *Eubranchipus vernalis* Verrill. The hermaphrodite belonged to form A, as already pointed out in a paper read before the American Association for the Advancement of Science, in August, 1880.

Owing to my often taking it out for closer inspection, it died after having been kept in the aquariam for three days.

Genital Organs.—The female side consisted exteriorly of two closed protuberances, a larger, less pointed one, opposite the cirrus, corresponding with the valvule, and a smaller one a little above the middle of the sac where the muscle m^2 is inserted. The internal female organs were but poorly represented, consisting of a somewhat triangular "oviduct," with its two elongate termini closed and suspended by three principal muscles. The latter

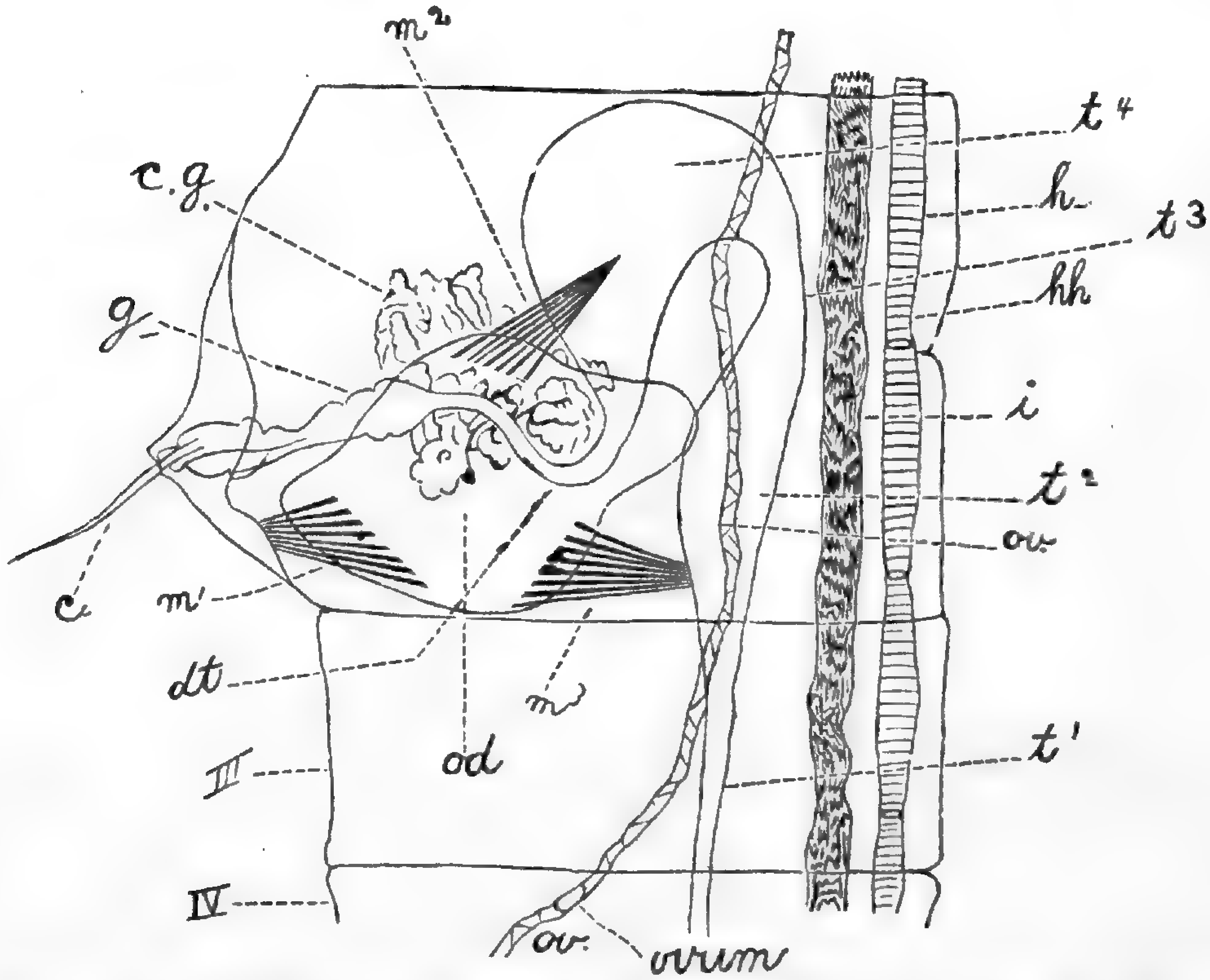

FIG. 1.—Hermaphroditic form of *Eubranchipus vernalis* V. The first three post-abdominal segments. *h*, heart; *hh*, ostium of heart; *i*, intestine; t^1, testicle; t^2, 1st dilated part of test.; t^3, contr. part or vas. def.; t^4, 2d dilat. part or sem. ves.; *dt*, duct ejac.; *g*, glandular and access. app.; *c*, cirrus; III, 3d post-abd. segt.; IV, 4th post-abd. segt.; *ov*, ovarial twisted string; *od*, oviduct, *ovum*-egg; *c.g.*, cement-glands; m^1 m^2 m^3, muscles of the oviduct.

anastomosed with the generally intricate mass of muscles. (The latter is omitted in Fig. 1.) Muscle m^1, of Fig. 1, was inserted near the larger, outer protuberance broadly spreading over the anterior terminus of the oviduct, the muscle (m^3) below the posterior terminus of the oviduct, and muscle (m^2) was inserted in the second smaller, outer protuberance.

This outer protuberance was constantly contracting and expanding itself, the area of the motion was exteriorly confined to this small protuberance only. The rhythmic contraction of the three principal fascicles revolved the "oviduct" to about one-fifth of its shorter diameter, in a semi-lateral direction.

There was no dissepiment between the male and female sac, and the interior uterine second sac was entirely absent in the female half.

The ovarial string passed up from the post-abdomen behind the detached "oviduct" and thence up to near the last left branchiped. The portion of the ovarial string passing through the genital segments was slightly moved backward and forwards, apparently by some hyaline fibers of the intricate mass of muscles connected with the "oviduct."

A single elongate white ovum *(ovum)* could be observed in the ovarial string in the fourth post-abdominal segment, near the third, during the entire time of observation.

The cement-glands were irregularly distributed in clusters around the posterior and middle part of the oviduct, the larger of them being between the latter and the male organs. The glands were all of a dark-brown color, which did not change during the time of observation, and were slowly moved to and fro by the network of muscles. The exterior of the female side was comparatively not as largely expanded as usual in normal individuals.

The internal male organs were of their normal course, shape and position; the exterior of the same presented, owing to the pointed lateral protuberance, the peculiar figure indicated by drawing Fig. 2, dorsal view. The male side was voluminously swollen out anteriorly.

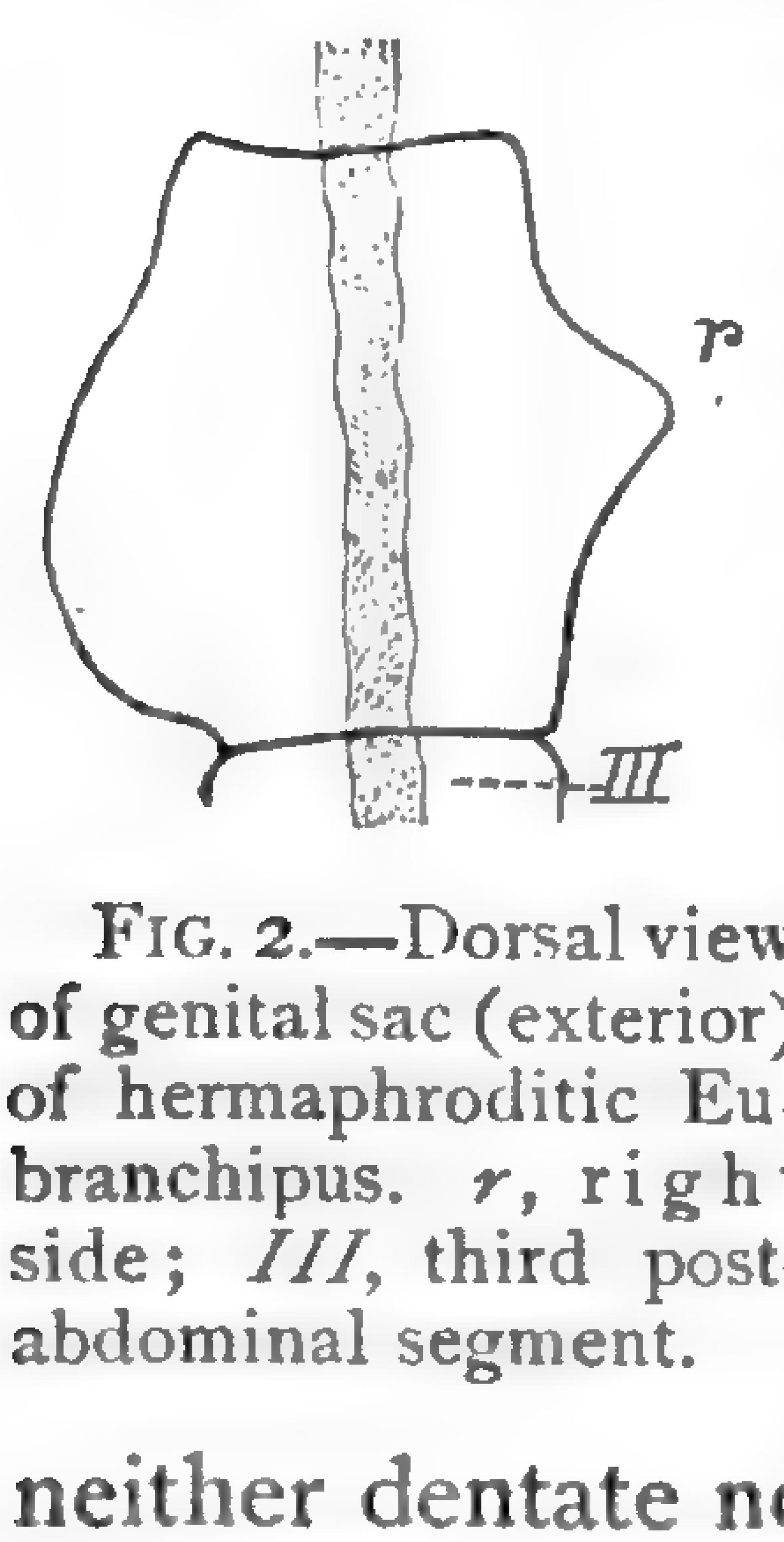

FIG. 2.—Dorsal view of genital sac (exterior) of hermaphroditic Eubranchipus. *r*, right side; *III*, third post-abdominal segment.

The female clasper (Fig. 3 *a*) was normal and of the form of those of the red Eubranchipus; the male clasper (Fig. 3 *b*) also presented the form of those of the normal red form, and was in its entire length very finely corrugated; the tips of both, the longer and shorter branch of the clasper were less corrugated than in the normal individuals. The tentacles on right side only and normal. Cirrus normal, neither dentate nor perforate.

Note.—I suspect the lateral protuberance on either side of the genital segment to be the exterior rudiments of a second evagination, corresponding with cirrus or valvule, the antimeres or duplicates of each exterior member, the female sac being in this case but a closed large protuberance.

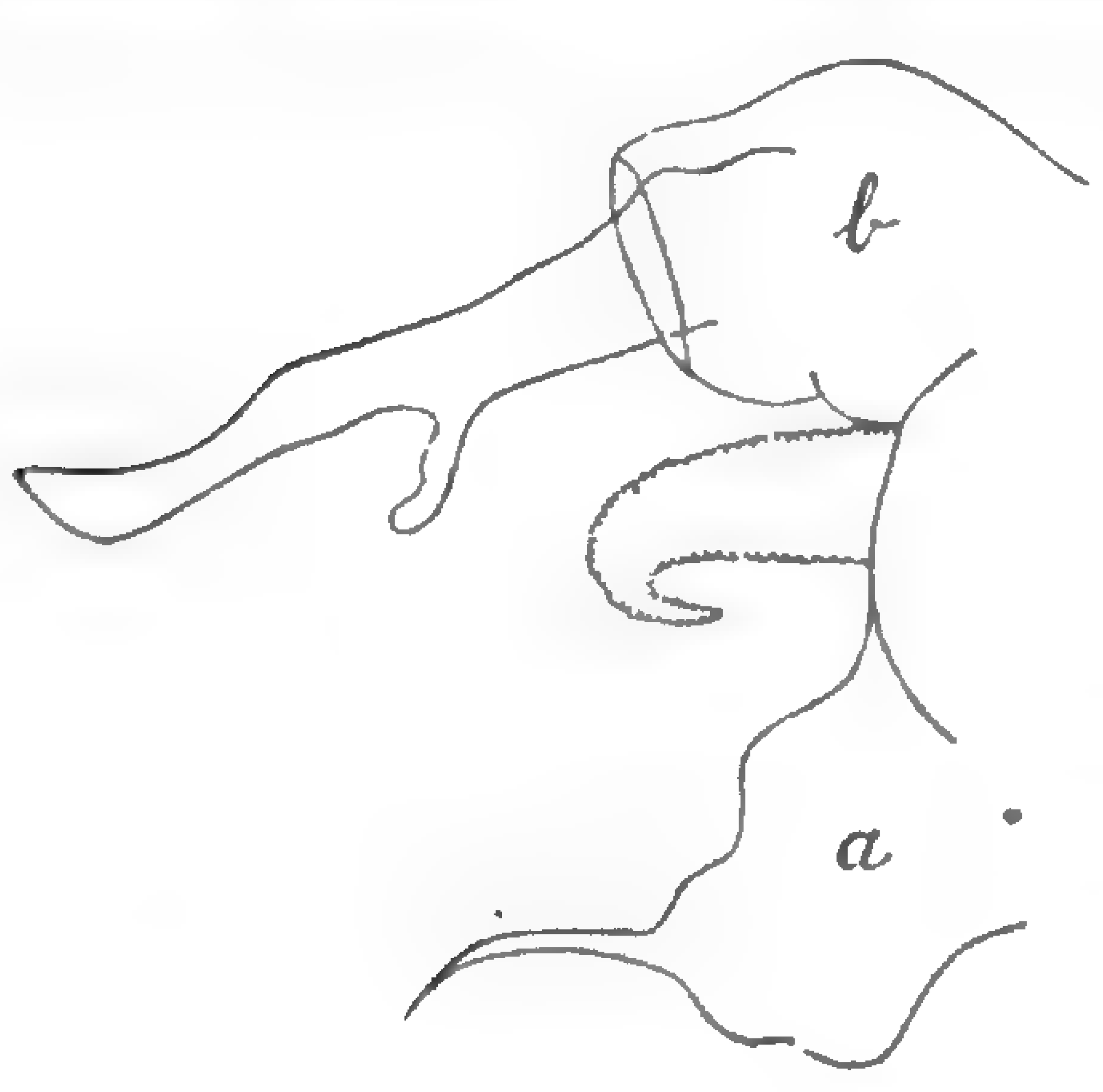

FIG. 3.—Head of hermaphroditic Eubranchipus.

This imperfect hermaphrodite may be compared with a male and female individual of Eubranchipus grown together side by side, the limbs, etc., in general consolidated, the male and female outer claspers, cirrus and valvule, being preserved (the latter also partly degenerated) along the median connate line, leaving the antimeres of the latter two external organs rudimentary in the shape of a protuberance or little knob on the lateral line.

The order in which the organs of reproduction and their auxiliaries make their appearance in Branchiopodidæ, is as follows: 1. Genital glands; 2. External genitals (Spangenberg's paper, p. 42), and 3. Auxiliary organs (claspers).—*C. F. Gissler, Ph.D.*

HABITS OF THE ENGLISH SPARROWS IN THE UNITED STATES.—The severe handling which that little immigrant, the English sparrow *(Passer domesticus)*, has of late received on all sides in the United States, and especially from our men of science, has sometimes made me feel disposed to consider the little fellow over abused, and has tempted me to say a word in his favor. But as even his enemies acknowledge he is more to be feared than despised, and as he has also not been without his advocates, I have hitherto refrained from interfering, and have remained a silent looker on.

One day in the early part of the month of January, 1880, during a high wind, a bird house occupied by birds of this species, and attached to a tree growing in the grounds connected with one of our public institutions, was brought to the ground by the giving way of a decayed branch. I was surprised to find it completely filled with a mass of rubbish consisting of dried grass, straw, weeds of various sorts (principally Amarantus and Chenopodium), horse hair, thread, rags, paper and feathers. The entire arrangement forbid the supposition that it was intended for nesting purposes, and an examination of the other sparrow-houses in the extensive grounds established the fact that they were similarly furnished. It was clearly a provision on the part of the bird against the cold of our severe winters. The gardener, who looked at it in the same light, informed me that he had to clean out this rubbish from the houses every spring at nesting time, and that it was not their nests, which are altogether different. This is exceedingly interesting as pointing to the capacity for self-improvement in the species. I have failed to find any description of such a habit in the English sparrow, and it would seem to have been acquired since its advent to our shores; though it would be important to know whether it adopts this precaution against the cold in the more northern countries of Europe.

A short time before the above-mentioned occurrence, one of those birds, in the same grounds, was noticed as being sick. Several of the other sparrows waited most assiduously upon it with affectionate care, and kept it supplied with food which they continually brought it. During the night a "cold snap" set in, and the next morning the sick bird was seen, perched on a railing, its companions hovering over it with evident anxiety, and bringing it food which they tried to make it eat. On going up to the bird, it was found to be dead and frozen stiff. This incident exhibits the species in a very different light from that in which it is usually represented by its American biographers.

But now comes the other side of the picture. In the following

April, at the blossoming of the peach, which this year was unusually early, I saw, one morning, two English sparrows busily at work on a peach-tree in my yard, and, on going nearer, perceived they were nipping off the blossoms with terrible rapidity. The ground was already strewn with scores of the crimson flowers, and I have no doubt that, unless interrupted, the tree, which is of a fair size, would have been utterly stripped—to the last bud, within less than half an hour. Close watching failed to discover the object of the birds, whether they were in search of insect or vegetable food, or whether their action was an exhibition of mere wantonness or destructiveness, which latter conclusion it would be difficult to receive. On the following morning another of the species was found similarly employed on a neighboring peach-tree, which was being just as rapidly denuded of its blossoms. The flowers were nipped off by the bird's beak, at the peduncle, a short distance below the receptacle, as neatly and swiftly as though done with a pair of scissors. This opened to my gaze such a horrible vista as to the destructiveness of the bird, that I turned away aghast at the spectacle. At this rate a few pairs of this sparrow would destroy the crop of an entire peach orchard in the course of two or three days. It cannot be, however, that this is a general habit of the bird, as our peach crop this season was the most abundant which we have had for years; fine peaches being retailed here, early in the season, at as low as three cents per quart.

Considering the destruction wrought by insect pests in our Southern States, I have thought this sparrow would prove of great benefit to that region, saving millions of dollars in the cotton, corn, vegetable and tobacco crops. The climate would also seem to be more suitable for it, particularly during the winter.—*Henry Gillman, Detroit, Michigan.*

Intelligence in a Cat.—The chief of our pets is "Shorty," a castrated cat now fourteen years old. Of course he has led a very quiet, dignified life, always at home, and never addicted to roof music at nights. He is a dear old fellow—neat and tidy in his habits, and taking the presence of any kind of filth as a matter of deep disgust and offence. In his middle age—avoirdupois sixteen pounds—he was a "mighty hunter." His greatest recorded feat being the killing of nine rats in one pleasant afternoon. It is an abomination in his ears to have them pierced by the "discordant noises" of a cat fight. One day, years ago, two younger felines engaged in an animated discussion with claws and teeth, filling the air with yells and flying fur. "Shorty" heard it, and ran in a succession of flying leaps to the spot. He bounded in between the two "bad boys," separating them in an instant. There he stood for a brief space, eyeing first one and then the other, with his right paw elevated, and growling fiercely. The youngsters drew down their arched backs, the bristling tails collapsed, and they left the spot, each in a different direction, at the command of the peace maker. He once "brought up" a motherless kitten. At first, he was highly indignant at the presence of the little one, but finally took charge of it most kindly and tenderly, allowing it to suck his rudimentary teats. He afterwards weaned it, and then hunted for it, precisely as a "mother kitty" would have done! "Shorty" seems always *sensible* of the fact, if any of the family are ill or feeling blue or discouraged; in such cases he springs into one's lap and purrs his loudest, *looking* his sympathy most unmistakably, as much as to say, "Don't feel badly—don't be discouraged!" On one occasion a lady of the family while suffering from a severe attack of toothache, burst into tears. "Shorty," who was regarding her intently, sprung upon her lap, and placing a paw on each side of her neck, looked into her face, giving utterance to frequent and piteous mews. That his friend was suffering grievously, he *knew* as well as anybody, and he manifested his sympathy and regret in quite as decided a manner. Many anecdotes of the old fellow are treasured up in the legends of the family, but the above are probably as characteristic as any. He is now in "the sere and yellow leaf," being afflicted with "rheumatics" when the weather is heavy, and having lost his under tushes, but we cherish him for the good he has done, and for the kindly sympathy he has always manifested for his friends.—*Chas. Aldrich, Webster city, Iowa,* 1880.

Curious Habit of a Dragon-Fly.—One day this summer when I was looking at some tadpoles in a dish of water, I was struck in the face by a jet of water. On searching for the cause, I found that the larva of a dragon-fly (Æschna) was my assailant. When disturbed it sent out a fine stream of water from the branchial apparatus in the caudal end of its body to the distance of two or three feet, and not content with one volley, it would wheel and discharge, like a small gun, at all points of the compass. I put it in a tumbler of water, and it lowered the front of the body, and shot the water far over the edge of the glass. I cannot say it ever took deliberate aim, but I know I got sprinkled many times when I inadvertently touched the glass.

Prof. Packard, in writing of the larval dragon-fly, says, "By a syringe like apparatus lodged in the end of the body, it discharges a stream of water for a distance of two or three inches behind it, thus propelling the insect forward. The apparatus combines the functions of locomotion and respiration." (Guide to the Study of Insects, p. 601.)

If all Æschnæ have the same habits as the one I caught, we must add that the apparatus is also a means of defence.—*Sarah P. Monks.*

Migrations of the Sand-Hill Crane.—I had to-day a fine opportunity to watch the migrations of the sand-hill crane, and observe their method of managing their flight under adverse circumstances, that is with a strong wind in the rear. They were flying at great height, and during two hours several hundred passed over, going towards the south-west, the wind at the time being nearly due north and blowing quite hard. They would proceed in the ordinary manner for a short time, and then when the wind apparently became too strong for them, would wheel round and face it, and allow themselves to be carried along by it in the same way that a fish sometimes lets himself be carried down a rapid current, tail foremost, by simply putting forth just strength enough to keep his head up stream. When the wind slackened they would again wheel and pursue their way to repeat the same manœuvre a little further on. This might seem to be a very slow mode of traveling, but after watching a number of flocks I concluded that their rate of translation could not be much less than that of an ordinary railway train.—*F. E. L. Bent.*

ZOÖLOGICAL NOTES.—The last report for 1878 of Prof. Baird, as Fish Commissioner, contains an elaborate descriptive essay on the *Pycnogonida* of New England and adjacent waters, by Mr. E. B. Wilson. These spider-like forms, formerly placed with the Crustacea, are now generally acknowledged either to form an aberrant group of Arachnida, or a group intermediate between the Crustacea and Arachnida. This is, except an earlier paper by Mr. Wilson, the first systematic treatment of these animals in this country, and the report is supplemented by excellent figures with many details. —— It is by some supposed that the *Monera* of Haeckel is a premature group and should be merged with the genuine Rhizopods; however this may be, a new (*Monopodium kowalevskyi*) has been discovered at Naples by K. Mereschkowsky. It has no nucleus, the point of distinction between Monera and Rhizopoda.——As regards the importance of *Foraminifera* to the doctrine of descent, Professor Moebius, contrary to Carpenter's opinion that owing to their unusual tendency to variation they were not of much value to the evolution theory, believes that as confirmatory of Darwin's theory of descent, they possess a value neither greater nor less than that of all other classes of animals.——As the last contribution to the question as to the origin of the radial symmetry of the Cœlenterates, Prof. John Young has argued from the order of development of the septa and tentacles, that the radiate form of Cœlenterates arises from the shortening and crowding together of the successive septa either side of a line of bilateral symmetry, by which an apparent radiation around the mouth is produced. ——Among recent ornithological publications is Dr. Coues' Third Installment of American Ornithological Bibliography. It forms over five hundred pages of the Bulletin of the U. S. Geological Survey of the Territories, v, No. 4. This, with the two other parts, "represent a nearly complete bibliography of ornithology, so far as America is concerned." The annual report of Capt. G.

M. Wheeler, Corps of Engineers, for 1879, contains an ornithological report on observations and collections made in portions of California, Nevada and Oregon, by Assistant H. W. Henshaw. Mr. Henshaw is now in Oregon and Washington Territory, taking the census of the Indian reservations in that region, but will doubtless find opportunities for ornithological studies in that interesting section.——Under the heading "Infusoria as parasites," Mr. W. S. Kent, in the *Popular Science Review*, enumerates ten species of *Flagellata* and fifteen species of *Ciliata* which are genuine parasites in the viscera of birds, frogs, &c., ducks and geese, house-fly, the blood of Indian rats, a nematode worm, the common cockroach, a myriopod (Julus), a water beetle, earthworm, a marine planarian of several fresh water snails, besides Dr. Salisbury's *Asthmatos ciliaris*, which he regards as an active agent in the production of one form of hay asthma or hay fever.——In a recent paper in *Kosmos*, Fritz Müller describes a Brazilian fly *(Paltostoma torrentium)* with two forms of females.

ENTOMOLOGY.[1]

Larval Habits of Bee-flies (Bombyliidæ).—In the last number of the *American Entomologist*, we gave from advance sheets of the Second Report of the United States Entomological Commission an account of the larval habits of Systœchus and Triodites, showing that they prey on locust eggs, and drawing the following conclusions:

The discovery of the "parasitism" of these bee-flies upon locust-eggs at once suggests a comparison with the similar diversity of parasitic habits among the Meloidæ as given in our first report, some of them infesting bee-cells, while others, as the true blister-beetles (Lyttini), feed on locust eggs.

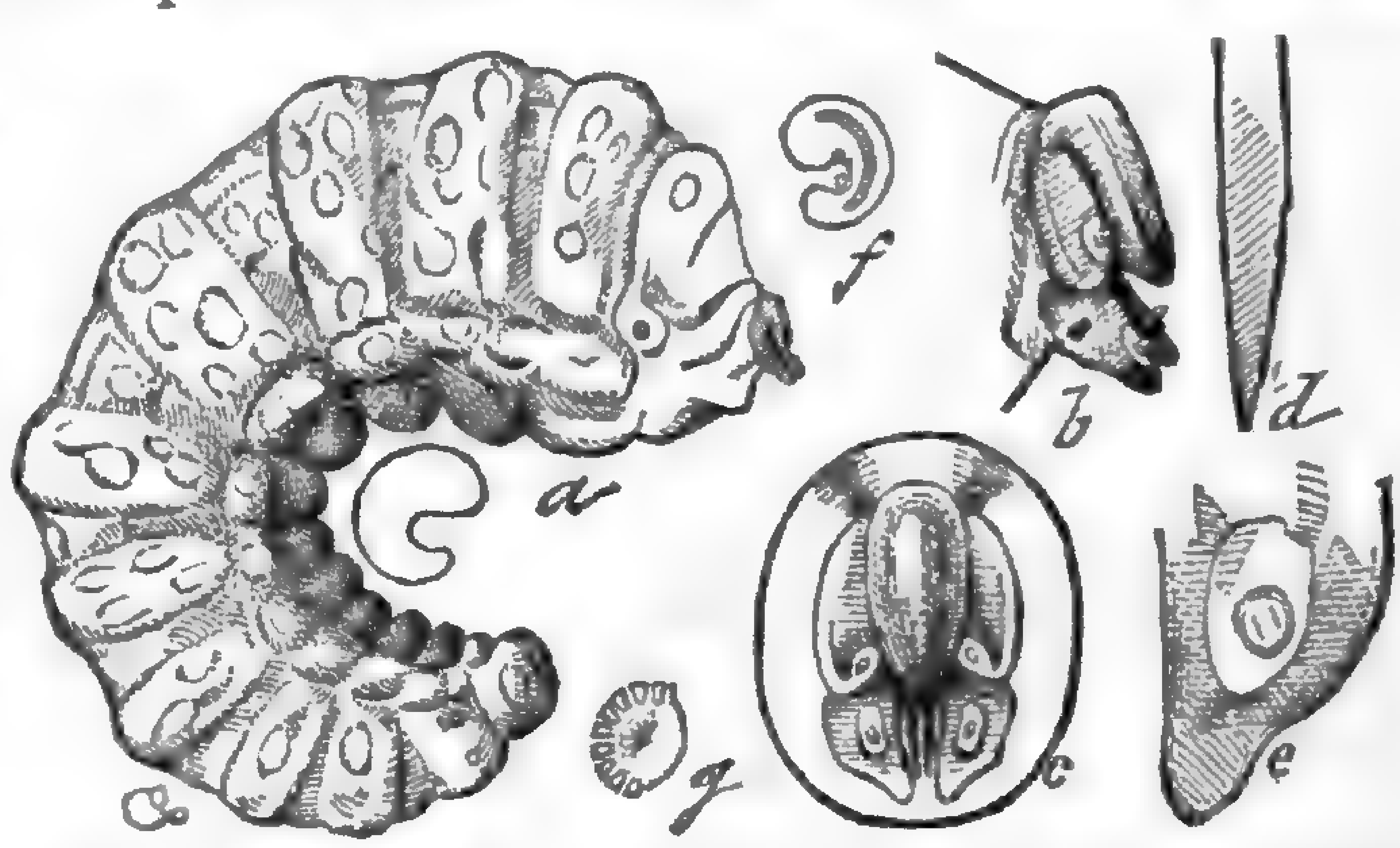

Fig. 1.—*Systœchus oreas*; *a*, larva; *b*, head, from side; *c*, do., from front, partly withdrawn into first joint; *d*, left mandible; *e*, left maxilla; *f*, prothoracic spiracle; *g*, anal spiracle (after Riley).

The Anthracids are now united by the best authorities with the Bombyliidæ, of which family as a whole Osten Sacken has said, they are "perhaps the most characteristic and one of the most abundantly represented families of Diptera in the western region, including California." The abundance of blister-beetles is also well known to characterize this region, and we have shown how this abundance is connected with the abundance of locusts. It is

[1] This department is edited by Prof. C. V. Riley, Washington, D. C., to whom communications, books for notice, etc., should be sent.

of interest, therefore, to find that the bee-flies bear a similar relationship of parasitism to the latter, and that the characterization of the fauna in these two groups is really dependent upon the presence of the locusts as well as upon the rich representation of the burrowing Hymenoptera.

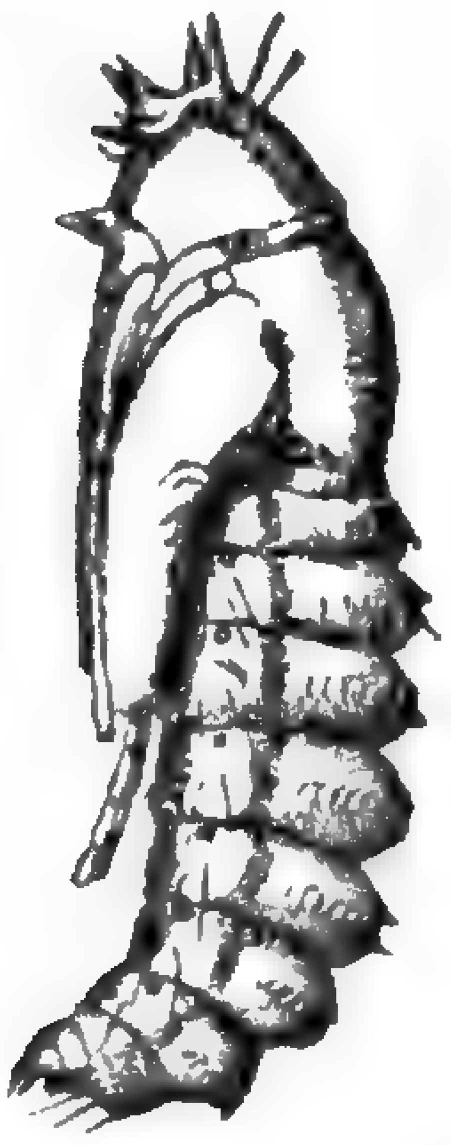

FIG. 2.—*Systœchus oreas;* pupa (after Riley).

Reviewing what had been published as to the larval habits of the true Bombyliids, we concluded that while there was strong presumptive evidence that they preyed on bee larvæ, there was yet no proof, and that the locust-egg-feeding habit we recorded, weakened the presumption. Since the publication of our article we have met with one previously overlooked, "On the Economy, etc., of Bombylius," by T. A. Chapman, M.D., in the *Entomologists' Monthly Magazine* for February, 1878 (Vol. XIV), p. 196. Mr. Chapman gives abundant proof of the parasitism of the European, *B. major*, on *Andrena labialis.* He records some observations on the oviposition of Bombylius, the small white egg being thrown with a short jerk against the earth near where the food of its future larva presumably occurred. This would also imply that, as in the case of the blister-beetles, the newly hatched larva must seek its food, and strengthens our suspicion that it will be found to be much more active than the mature larva. Mr. Chapman very fully describes the mature larva and the pupa, and his descriptions show that in all essential points the larva of Bombylius accords with those of Triodites and Systœchus. We quote his description of the head: "The head is set into this segment [the 1st thoracic] and is retractile; it is very small; its center is occupied by a prominent wedge-shaped portion, the point of the wedge being downwards, and immediately in front of the mouth. Immediately beneath this are two black, very sharp, setiform jaws (?); on each side is a papillary eminence (antenna?) of three joints set in a circle of softer tegument, and immediately below project downward on each side two large palpi (labrum?) looking like jaws, but having a vertical, not a lateral mobility, on the anterior face of each of these there is a palpus of some length, apparently unjointed, set in a circle." It will thus be seen that he homologizes the parts

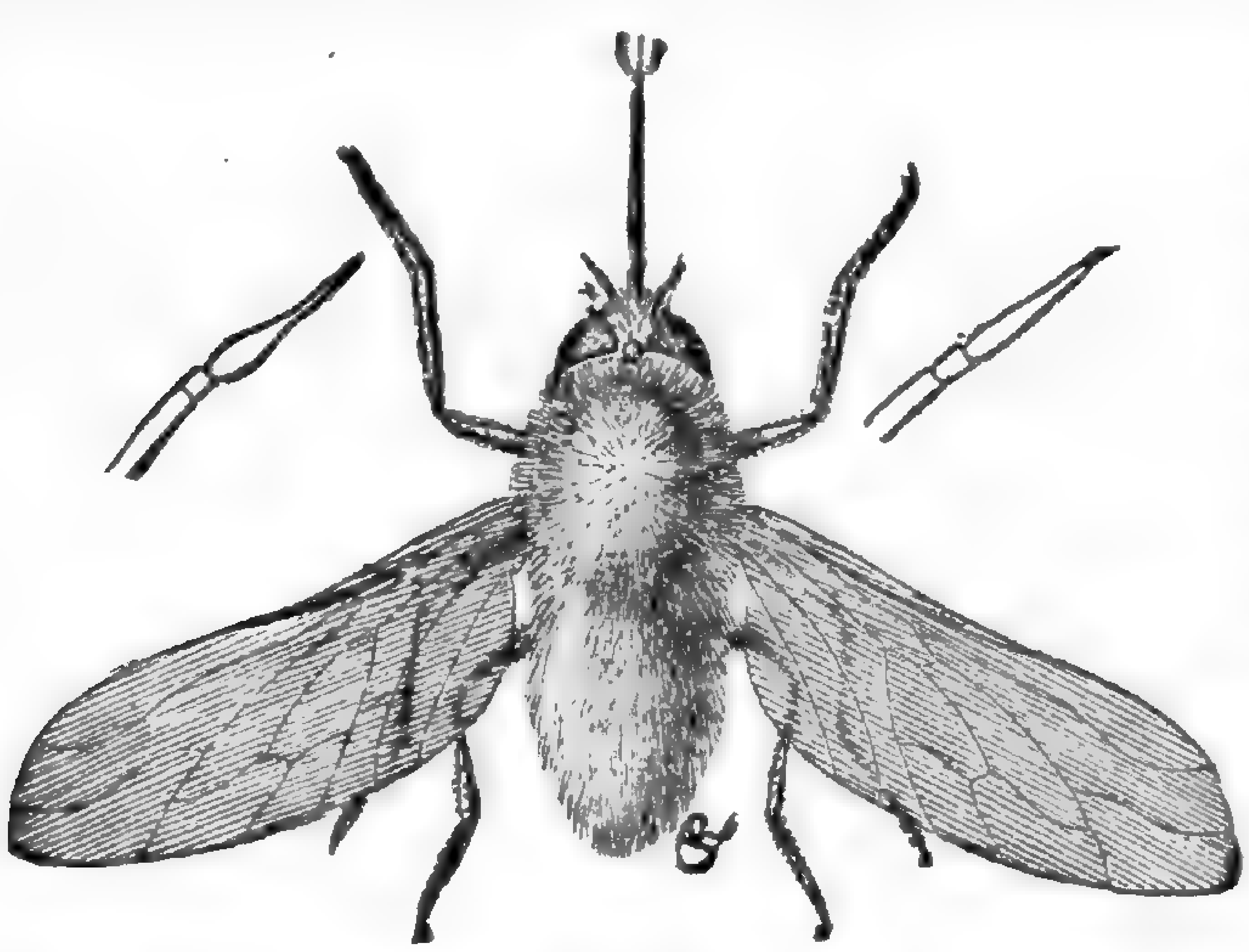

FIG. 3.—*Systœchus oreas;* female; antenna, side view, to left; do. top view, to right.

much as we have done, except that he refers the two lower palpigerous pieces, with a question, to the labrum (misprint for labium?) which they cannot possibly be; they are evidently the maxillæ. The upper lateral pieces bearing the antennæ are much less conspicuous, judging from the description, in Bombylius than in Systœchus. The pupa of Bombylius, from Dr. Chapman's excellent description, differs in the greater prominence and somewhat different arrangement of the cephalic spines, the anterior pair being stouter and more bent forward than in either of the genera we have treated of. Dr. Chapman speaks of these spines forcibly reminding him of the tusks of a walrus and of their admirable adaptation to tearing down the clay stopping and digging through as "with mattock and shovel" the long burrows of the bee upon which it preys. The dorsal and anal spines are also much more prominent than in our locust-egg parasites. The pupa of Systœchus and Triodites, not being under the necessity of such strenuous digging, have a less formidable armature; otherwise there is strict structural correspondence with Bombylius.—*C. V. Riley.*

Experiments with Pyrethrum: Safe Remedies for Cabbage Worms and Potato-Beetles.—The following experiments with Pyrethrum were made, at our request, by Prof. A. J. Cook, of the Michigan Agricultural College, at Lansing. They are interesting as confirming all that we have hitherto said in recommendation of this powder for the imported cabbage worm, no safe and satisfactory remedy for which had been discovered before we recommended this powder and showed that it could be economically used when simply mixed with water. Its value, used in this way, for the Colorado potato-beetle as a substitute for the more dangerous arsenical compounds will at once be appreciated.—*C. V. R.*

Sept. 27, 1880.—I placed ten cabbage caterpillars (*Pieris rapæ* Schrank), in each of two small wooden boxes which were covered with wire gauze. In one box I dusted the least possible amount of Pyrethrum mixed with flower in the proportion of one part of the Pyrethrum to twenty parts of the flour. I sprayed those in the other box with a liquid mixture, using one tablespoonful of Pyrethrum (7 grammes $\frac{1}{60}$ lb) to twenty gallons of water. In five minutes all the larvæ were on their backs. Nor did any of them recover. A large number of the caterpillars on the cabbage plants were sprinkled or dusted with the Pyrethrum, the proportion the same as given above. In one hour the plants were examined and in every case the caterpillars were found dead.

The same experiments as those detailed above were tried with the potato-beetle (*Doryphora 10-lineata).* Those in the boxes were all down in fifteen minutes, both beetles and larvæ; nor did they recover. I watched those on the vines for twenty minutes, when several had fallen to the ground. These were some distance from my home, and I could not watch them longer. Whether all dropped or not I am not able to say, nor whether all or any recovered.

Wednesday, Sept. 29, 1880.—In the following experiments the cabbages were simply dusted or sprinkled with no effort to secure actual contact of the liquid or powder with the larvæ. The experiments were tried under my direction by a very trusty and careful assistant, Mr. Will. R. Hubbert, with the following results:

1st Experiment.—By use of a common sprinkler, nine cabbages were treated with the liquid mixture, composed of one tablespoonful of Pyrethrum (7 grammes) to a gallon of water. In one and one-half hours after the application, a *hasty* examination discovered thirteen dead larvæ and three live ones.

2d Experiment.—Ten cabbages were treated the same as above, except that two applications of the liquid were made; nineteen dead larvæ and one live one were found.

3d Experiment.—Twenty-six cabbages were treated with a liquid mixture of one tablespoonful of the powder to two gallons of water. One application was made with Whitman's Fountain Pump. Eleven dead and four live larvæ were found.

4th Experiment.—The same as experiment 3, on thirteen cabbages, except that two applications of the liquid were made. There were five dead caterpillars and two alive.

5th Experiment.—Twenty cabbages were dusted with a powder compound of one part of Pyrethrum to forty of flour; five dead larvæ and one live one were found.

6th Experiment.—Twenty cabbages were treated the same as No. 5, except that the mixture was in the proportion of 1 to 20; three dead and three live caterpillars were found.

The examinations in all the above cases were made one and one-half hours after the application of the liquid. The examination was too hasty to be thorough.

The next day all were again examined with great care, so that very few, if any larvæ were omitted in the count.

No. 1.	9 Cabbages,	17 dead,	39 stupefied,	3 alive.
" 2.	10 "	42 "	30 "	1 "
" 3.	26 "	18 "	0 "	58 "
" 4.	13 "	25 "	3 "	1 "
" 5.	20 "	18 "	3 "	9 "
" 6.	20 "	9 "	0 "	1 "

Friday, Oct. 1, 1880. *Experiment 1.*—Treated twelve cabbages: used one gallon water and ½ spoonful of Pyrethrum. Careful examination revealed eleven dead and eleven alive.

Experiment 2.—Twelve cabbages: used one gallon water to ¼ spoonful (2 grammes) of the powder. Eleven dead and four alive.

Experiment 3.—Twenty-six cabbages: used Pyrethrum and flour 1 to 40. Three dead, five alive and one stupefied.

Experiment 4.—Twelve cabbages: one gallon water to one spoonful of the powder. Result, thirteen dead, four alive and four stupefied.

The above experiments show conclusively that this powder is fatal to the caterpillars, and that too in very dilute liquid mixtures, as only $\frac{1}{200}$ of a lb. to the gallon of water was used in Exp. 2 of Oct. 1st, and eleven larvæ were killed. We have only to sprinkle it on to the plants, though it may be necessary to make more than one application to insure complete success. The success was better with the liquid than with the flour mixture, and can be applied with greater speed and economy.

A twig of alder *(Alnus serrulata)*, covered beneath with wooly Aphides *(Eriosoma tessellatum* Fitch), was dipped into the liquid mixture of $\frac{1}{60}$ lb. to a gallon of water. The next morning all the lice had fallen to the ground, never to rise again.

Flies and mosquitoes in a room where the powdered Pyrethrum had been blown in not very large quantities, less than $\frac{1}{100}$ of a lb. to a room twelve feet square, were felled to the floor, where nearly all remained till morning; though the application was made the night before. If not swept up some of the flies would recover. The flies commence to fall in ten minutes.

Squash bugs *(Coreus tristis)*, were kept in the clear powder, in a close tin box, for three days, and were still alive. I also sprinkled and dusted these insects on the vine, and could see no signs of success in killing them.

The Food of Fishes.—We have received an interesting contribution, with the above title, by Prof. S. A. Forbes, from Bulletin No. 3, Illinois State Laboratory of Natural History, November, 1880. The author gives the results of a large series of examinations of the stomachs of darters, perches, bass and sunfishes. He also separately considers the food of the young fishes as distinguished from that of the adult. His investigations have led to some interesting general conclusions, among which we commend the following as applying to studies in other departments of Natural History as well: "Nowhere can one see more clearly illustrated what may be called the *sensibility* of such an organic complex—expressed by the fact that whatever affects any species belonging to it, must speedily have its influence of some sort upon the whole assemblage. He will thus be made to see the impossibility of studying any form successfully out of relation to the other forms—the necessity for taking a comprehensive survey of the whole as a condition to a satisfactory understanding of any part. If one wishes to become acquainted with the black bass, for example, he will learn but little if he limits himself to that species. He must evidently study also the species upon which it depends for its existence, and the various conditions upon which *these* depend. He must likewise study the species with which it comes in competition, and the entire system of conditions affecting their prosperity. Leaving out any of these, he is like one who undertakes to make out the construction of a watch, but overlooks one wheel; and by the time he has studied all these sufficiently, he will find that he has run through the whole complicated mechanism of the aquatic life of the locality, both animal and vegetable, of which his species forms but a single element. * * * * "I cannot too strongly emphasize the fact frequently illustrated, I venture to hope, by the papers of this series—that a comprehensive survey of our entire natural history is absolutely essential to a good *working knowledge* of those parts of it which chiefly attract popular attention—that is, its edible fishes, its injurious and beneficial insects, and its parasitic plants. Such a survey, however, should not stop with a study of the dead forms of nature, ending in mere lists and descriptions. To have an *applicable* value, it must treat the life of the region as an organic unit, must study it *in action*, and direct principal attention to the laws of its activity."

Prof. Forbes believes, from results so far obtained, that it will prove to be a rule "that a fish makes scarcely more than a *mechanical* selection from the articles of food accessible to it, taking almost indifferently whatever edible things the water contains which its habitual range and its peculiar alimentary apparatus enable it to appropriate, and eating of these in about the ratio of their relative abundance and the ease with which they can be appropriated at any time and place. If this is so, knowing the structure of a fish and the contents of a body of water, we shall be able to tell, *a priori*, what the fish will eat if placed therein."

INSECT ENEMIES OF THE RICE PLANT.—In the October number of the *American Entomologist* (Vol. III, p. 253), we published an interesting communication from Mr. John Screven, of Savannah, Ga., addressed to Dr. J. L. LeConte, regarding insects injurious to the rice plant. We then referred the Scarabæid larva (or "grub") which feeds upon the roots provisionally to the genus Ligyrus, being led to this conclusion by the circumstance that a species of this genus (*L. rugiceps* Lec.) attacks, in a similar way, the roots of sugar cane in the south, and that another species (*L. relictus* Say,) which is common farther north, has been observed feeding on the roots of wild rice in the marshes bordering Lake Erie. Meanwhile Mr. Screven kindly sent us specimens of the perfect insect, which proves to be a closely related form, *Chalepus trachypygus* Burm. This beetle occurs through the whole extent of the Southern States, and is very common along the edges of the swamps, in the pine barrens and in similar moist grassy places, feeding both in the larva and imago states on the roots of grasses.

Of the second species attacking the roots of rice, the "maggot" of Mr. Screven (see *Am. Ent.* III. p, 262–3), no perfect insects have been received yet, but renewed examination of the larva seems to confirm our opinion previously expressed (l. c. p. 253), viz: that it is a Cerambycid allied to Oberea. If so, the species in question is possibly *Spalacopsis suffusa* Newm., which is by far less rare in the Southeast than is generally supposed. The perfect insect occurs in large numbers, in June and July, in very wet grassy places, its larva doubtless boring in the stems or roots of grasses which are more or less covered with water. The beetle, however, is very liable to be overlooked even by an experienced collector, as when approached it "plays possum" and is then almost undistinguishable from a piece of dry grass.

The "water weevil" mentioned by Mr. Screven as injurious to rice we conjecture to be a species of Centrinus (perhaps *C. concinnus* Lec.?) or of an allied genus of the Barini group, as several species thereof occur in great numbers in wet, grassy places in the South, and as the larvæ of this group are known to live in the roots or stems of plants.

In this connection we would finally call attention to the reported recent appearance of a formidable insect enemy to the rice plant in the East Indies. Mr. Wood Mason, deputy superintendent of the India Museum has identified it as belonging to the genus Cecidomyia, which genus "has never before been found in India," and proposes the name of *C. oryzæ*, for the species, which threatens to become very destructive to the rice crop.

Description of a New Species of Cynips.—*Cynips q. Rileyi*, n. sp.—The galls of this species have been accurately figured in the *American Entomologist*, Vol. III, p. 153, by Prof. Riley, who received them from North Bend, Ohio. In the only specimen I have, the twig on which the galls grow is three-sixteenths of an inch in diameter and the galls rise about one-fifth of an inch, but the specimen figured is apparently larger than mine. As Prof. Riley has remarked, the galls bear some resemblance to those of *C. q. punctata* B. The latter are, however, of a hard woody structure, while the former are of a cork-like consistence, and apparently quite destitute of woody fiber. As all the flies I have reared from these galls are females I think it will prove to be the one-gendered form of one of our many dimorphic species To this new and in many respects very interesting species I have given the name of my esteemed fellow-laborer in this interesting branch of entomology, and to whom I am indebted for the specimens described.

Galls. Abrupt, irregular swellings on the twigs of *Quercus castanea;* varying in size and form from round, pustule-like bodies, one-fourth of an inch in diameter, and containing a single larva to a confluent mass of galls an inch or more in length and half an inch in diameter and containing many larvæ. The larger ones sometimes nearly or quite encircle the twig. Externally they are covered with a smooth, healthy bark like the unaffected parts of the branch. Internally they are of a dense cork-like substance, which is inseparable from the enclosed larval cells.

Gall-fly. Head black, smooth and shining. Antennæ short, antennal joints thirteen; 1st joint, short, thick, truncate, 2d, short, oval; in color both are of a dark amber; 3d joint equal to the two preceding taken together, color yellowish-brown; 4th to 13th inclusive, a dusky yellowish-brown. Face black; mandibles yellowish, with black tips. *Thorax* small. Mesothorax rises abruptly above the very narrow collare; it is smooth, shining, black and grooveless, but under a one-eighth magnifier presents a minutely crackled surface, with a few scattered white hairs. Scutellum smooth, rounded and separated from the anterior portion of the mesothorax by a broad, shallow and highly polished groove. Wings small, hyaline, veins dark brown, heavy; the subcostal uniform its entire length, areolet large, well defined; radial area long and narrow, open. *Legs* dark shining brown, with pale yellowish joints. *Abdomen* subpedicellate, smooth, black, polished; in dry specimens truncate by the insheathing of the last three segments within the others.

Length, .11. Length of wings, .11.

Described from 12 specimens, all females, in my collection.—*H. F. Bassett, Waterbury, Conn.*

THE "YELLOW FEVER FLY."—In the last number of *Psyche* (September, 1880), Dr. H. A. Hagen gives some references to a fly belonging to the genus *Sciara*, which has been dubbed the "Yellow Fever Fly," presumably, judging from the context of the article, because it has been observed to swarm more particularly during yellow fever epidemics. The larvæ of this genus of flies are well known to feed upon the humus in soils and other decaying vegetable matter, and it is more than probable that the conditions which favor the development of the yellow fever also favor the development of these flies. We certainly cannot conceive any other connection between the insect and the disease. Based upon a list of swarms of Diptera by Prof. Weyenburg in 1861, in which *Sciara* is not included, Dr. Hagen considers the appearance of this fly in swarms, as described by Dr. Ravenel in South Carolina, as new. We have frequently observed them in swarms sufficiently dense to appear, at a short distance, like smoke.

The following unpublished letter received by us, with specimens, from Mr. S. S. Rathvon, of Lancaster, Pa., nearly twelve years since (March 22, 1869), also refers to flies of this genus as recorded in the *American Entomologist* (1, p. 186):

"I enclose a quill containing some Dipterous insects, which I received a few days ago from a friend in Bethlehem, Pa. He says they came out of the cracks between the floor boards, in July, in one of the upper rooms of a new addition built to their seminary, in millions. He counted five thousand on a single window, partly flying and partly running up the panes of glass. What seemed remarkable to him was that not one was seen in any other part of the house. Whilst living the wings were iridescent, but after death they lose this color. Near the end of August, last year, I had a partition fence painted on my premises, when the whole surface became covered with millions of little flies, with iridescent wings, very similar to these, and perhaps the same species. I confess that I know nothing about their name or history, although I have often noticed them adhering to newly painted buildings during spring and summer. What are they?"

Ways of Limenitis bredowii.—Mrs. A. E. Bush sends from San Jose, Cal., the following account of the flight and habits of this beautiful butterfly:

They are warriors and seem to have a good deal of character. They alighted on the white or black oaks high above, and with the appearance of being on the alert, waited till a large yellow Papilio came in sight, when it was chased away, and Limenitis returned to his perch awaiting for the next fray. A smaller butterfly routed the Limenitis, however. They were shy of light colors. When I had on a light-colored dress I could not get near one, but with a brown dress they would alight on it, and about my feet. Throwing small pebbles, chips or rocks at them seemed to enrage them, and they would follow anything thrown at them back to the ground. A Grapta, on the contrary, was attracted by a white hat, and hovered around my head like a bee above the flowers, and would alight on the hat and on my hand.

Habits of Xylotrechus convergens.—The larva of this Longicorn beetle infests what we call thorn apple or red haw; comes to maturity in one year, and the imago makes its appearance about the 15th of June. I have taken it as late as July 1st. It kills the tree in one year after the egg is laid in the crevices of the bark. As soon as hatched the larva enters the wood, and hardly travels six inches. I am the only one here who has taken it so far; I have taken twenty out of a piece of wood three feet long.—*M. J. Myers, Ft. Madison, Ia., in letter to Dr. J. L. Le-Conte.*

An Aquatic Sphinx Larva.—In the same number of *Psyche* above referred to, is an interesting communication by Baron von Reitzenstein, of New Orleans, La., describing a sphinx larva belonging to the genus Philampelus, which he found feeding on the floating Nymphæa in the centre of a draining canal, the whole body, with exception of the thoracic segments, being submerged under water. The larvæ are described as swimming with great facility from one patch of plants to another.

ANTHROPOLOGY.[1]

Early Man in Britain.—The latest utterance upon this subject is from the pen of the distinguished cave hunter, Prof. W. Boyd Dawkins, entitled, "Early Man in Britain, and his place in the Tertiary Period," published in London by Macmillan & Co. The subject is treated in the three-fold point of view of the geologist, the prehistoric archæologist, and the historian. Beginning with the earliest period during which man is alleged to have made his appearance, the author passes downward through time, or, what is equivalent, upward through the geological record to the prehistoric iron age. The Tertiary period is divided into six

[1] Edited by Prof. Otis T. Mason, Columbian College, Washington, D. C.

parts (p. 9): I. Eocene (living orders and families present); II. Miocene (living genera); III. Pliocene (living species); IV. Plistocene (living species abundant, man appears); V. Prehistoric (man abundant, domestic animals, cultivated fruits); VI. Historic (historic records).

Britain in the Eocene is described geologically and geographically, and after examining carefully the fauna and the flora, Mr. Dawkins concludes that man has no place in such an assemblage of animals. Nevertheless, the lowest member of the Primates was represented in the upper Eocene of Europe, and throughout the whole of that period in America.

The Miocene is divided likewise into upper, middle and lower, and the distribution of land and water, plants and animals, as well as the changes of climate and sea level discussed in the light of recent research. Was man in Europe in the Miocene age? All the conditions necessary to the primeval garden of Eden were satisfied. The flints of Thenay and the notched rib of Pouance are allowed their due weight, and yet Prof. Dawkins decides upon the whole, that the data are insufficient to establish man's contemporaneity with the Dinothere and other members of the Miocene fauna.

The Pliocene age is next passed in review, with the same systematic treatment. Europe is no longer joined with America, and profound changes take place in the geology, climate, fauna and flora of the former. The author, however, rejects the skull of Olmo, the cut bones of Tuscany, and other evidences of Pliocene man. He says, "Of twenty-one fossil mammalia in the Pliocene of Tuscany, only the hippopotamus is now living on earth. It is improbable that man should have been present in such a fauna. They belong to one stage of evolution and man to another and later."

Prof. Dawkins finds his earliest man in the Plistocene. The chapters upon the fauna of this age and the two races: the Drift men and the Cave men, are, to our thinking, the best in the book. In opposition to Mr. Evans, the author holds that these two series are entirely distinct states of culture, of which the Cave men are the newer and the higher. We are without a clue to the ethnology of the River-drift man, but the many points of connection between the Cave men and the Eskimos can be explained only on the hypothesis that they belong to the same race.

Then follows the civilization of the Prehistoric period, covering all the events which took place between the Pleistocene age and the beginning of history. No break of continuity is allowed, but the Tertiary period is looked upon as extending down to the present day. The Prehistoric period is divided into three ages, the Neolithic, the Bronze, and the Iron age. In the former men were divided into tribal communities, engaged in agriculture, herding and fishing. Spinning, weaving, mining, boat-building, traffic by land and by water had begun to flourish. The dead were entombed under such conditions as to give an insight into the religious convictions of the people. On page 293 is the pregnant sentence, that each palafitte hut was inhabited by one family, and the whole settlement was not a community with common store houses, like a Mexican pueblo. This Neolithic culture is derived from Asia, and, after summing up the evidence, Mr. Dawkins regards the people as of the Iberian stock. They were succeeded by the Celts, who were, *par-excellence,* the Bronze age race. The various questions which have sprung out of the remains, as the origin of bronze, tin mines, the duration, culture, and religion of the Bronze age are elaborately worked up in chapters x and XI. The following and closing chapters treat of the Iron age, and the overlap of history, under which last head the influences of Egyptian, Assyrian, Phœnician, Etruscan, and Greek civilization upon that of Western Europe are briefly discussed.

It is to be regretted that our limited space will not permit us to enter more elaborately into the merits of this work, nor to speak of its defects any further than to draw attention to oversights, and a lack of consistency here and there in the proof-reading of an otherwise very handsome volume. If Mr. Dawkins has not already thought of the matter, we would call attention to the similarity of the flames from the head of the Dol-ar-Marchnant (page 305) to the speaking girdles and other like signs for voice and emotion in the works of Stephens and Hable.

THE ANTHROPOLOGICAL SOCIETY OF PARIS.—The *Bulletins* of this world-renowned society from January to April of the past year, have reached us through the Smithsonian Institution. In addition to the lists of officers and members, proceedings and correspondence, the following papers are given in full or in abstracts:

Sur la signification de la croix dit svastika et d'autres emblêmes de même nature, by Girard de Rialle; Sur les Lapons, by M. Mantegazza; Sur les Migrations en Egypte, by Emilie Soldi; Sur les Boschimans et les Hottentots, by M. Féraud; Inventaire des Monuments Mégalithiques de France: Report of a sub-Committee, composed of MM. Henry Martin, Daubrée, G. De Mortillet, Paul Broca, Cartailhac, Chantre, Leguay, Pomel, Salmon, du Sommerard, de Berthélemy, Fabsan, Trutat, and Viollet le Duc. [This is a detailed enumeration by departments of all the dolmens, menhirs, aleignments, cromlechs, cup stones, and other archæological localities throughout France]; Crâne Australien Brachycephalique, by M. Cauvin; Méthode trigonometrique: le goniométre d'inclinaison et l'orthogone, by Dr. Paul Broca; Sur un questionnaire anthropométrique a remplir dans les ecoles du departement de Loir-et-Cher, by M. Jacques Bertillon; Le developpement du cerveau chez les enfants du premier age, by M. J. Parrot; Sur le goniométre flexible, by M. Paul

Broca; Sur la traduction des inscriptions cambodgiennes, by M. Harmand; Sur l'utilité de rédiger des instructions linguistiques, by M. Vinson; Sur un Manuscrit de M. Régis Gery, by M. G. de Mortillet; Sur les Esthoniens, by M. Arthur Chervin; Sur l'ethnologie de la Nouvelle Guinée, by M. Mantegazza; Sur la vision de la serie des nombres, by M. d'Abbadie; Sur le buste d'une jeune fille zoulon, by M. Paul Broca; Sur une anomalie regressive de la crosse de l'aorte chez une jeune fille zoulon, by M. Paul Broca; Le cerveau de l'assassin Prévost, by M. Paul Broca; Sur la monographie de la femme de la Cochinchine, by M. Mondière; Sur les resultats d'une mission en Australie, by M. Cauvin; Sur les comptes de l'exposition des Sciences anthropologiques, by M. Issaurat; De différent instruments d'anthropométrie, by M. Paul Topinard; De l'influence du mariage sur la tendance au suicide, by M. Jacques Bertillon; Sur la génération au point de vue chronologique, by M. Réné de Semallé: Sur le voyage de M. Panàgiotis Patagos en Asie Centrale, by M. Ch.-E. de Ujfalvy; Sur l'usure spontanée des dents au point de vue ethnique, by M. E. Magitot; Sur les Sépultures doubles de Thuizy (Marne), by M. Edouard Fourdrignier.

Fossil Men and their Modern Representatives.—Under the foregoing title, Principal J. W. Dawson has published, through Dawson Brothers, of Montreal, an "Attempt to illustrate the characters and condition of prehistoric men in Europe, by those of the American Races." In this volume we have really two books, upon entirely different subjects. What we may call book first is a parallel between the ancient town of Hochelaga, discovered by Cartier in 1534, and occupying the site of modern Montreal, and the ancient stone people of Europe. The author's opportunities for following up a line of investigation initiated by Sir John Lubbock have been exceptionally good and he has not failed to use them, supplementing the data of Hochelaga with facts collected among our present red Indians. In the course of the argument the author throws out some pregnant suggestions; as, for example, the impossibility of maintaining the definite nomenclature of archæòlogy popular ten years ago; the similarity of the oldest populations of Europe, the river drift and the cave men, to American aborigines; the identity of Schoolcraft Allegans with the Mound-builders; the anteriority of polished stone to rude stone folk; the spoke-like burial in the mounds as an imitation of lying in a teepec with the feet to the fire; the communal characters of the Swiss palafittes; the totemic significance of the engravings on bone in the European caves, &c. The portions of the volume designated here as the second book, are an argument to prove that all the events indicated by the discoveries of archæologists, in river-drifts, in caves, and in lake deposits, occurred in a few thousands of years. Without trying to follow Dr. Dawson in his discussion, it is but fair to say that his profound knowledge of palæontology has enabled him to present the brachy-chronic view of archæology more forcibly than Mr. Southall or any other recent writer who has made the attempt.

GESTURE SIGNS.—Col. Garrick Mallery has issued, for collaborators only, a limited number of a quarto pamphlet of 329 pages, entitled, "A Collection of Gesture Signs and Signals of the North American Indians, with some comparisons. Washington, Government Printing Office, 1880." The work will not be published permanently in its present shape; but the descriptions are presented for the verification of observations, verbal corrections, and to secure accurate classification and comparison. Every contributor is thus enabled to revise his own work, as the volume is divided and arranged according to a scheme of linguistic families and subordinate languages or tribes. The author has taken the liberty to use his own judgment as to the admission or rejection of authorities, drawing a hard and fast line against all loose generalizers and vague talkers about what they have not examined in person over and over again. The amount of patient, critical discernment necessary to render such a work really valuable can be appreciated only by a careful study of Colonel Mallery's prefatory remarks, pp. 1–7, in which the principles which have guided him are clearly set forth.

REPORT ON INDIAN AFFAIRS.—Strange as it may seem, scholars seldom consult the report of the Commissioner on Indian Affairs for information concerning the Indians. In preparing his colossal work on the Native Races of the Pacific States, Mr. H. H. Bancroft examined the entire series up to 1872, but found only here and there a scrap of intelligence. Very notable exceptions to this sweeping statement are to be found, such as the papers of Governor Stevens and the report of General Walker, in 1872. We find reason to qualify our statement, also, in the report of Commissioner Hayt, for 1879. On page 118, Agent B. M. Thomas gives a list of all the inhabited Pueblos in New Mexico and Arizona, with their population, and an altogether too short sketch of their government. It is to be hoped that those who have the best possible opportunities of studying our aborigines will make better use of their time in the future.

TRANSACTIONS AND PROCEEDINGS OF THE NEW ZEALAND INSTITUTE.—Vol. XII of this valuable series for 1879, issued May, 1880, is not devoid of interest to the anthropologist, as the accompanying list of papers will show:

Notes on Port Nicholson and the natives in 1839. By Major Charles Heaphy.

On the ignorance of the ancient New Zealander of the use of projectile weapons. By Coleman Phillips.

Contributions towards a better knowledge of the Maori race. By W. Colenso.

Notes on an ancient manufactory of stone implements at the mouth of the Otokai creek, Brighton, Otago. By Prof. Julius von Haast.

Notes on the color-sense of the Maori. By James W. Stack.

Remarks on Mr. Mackenzie Cameron's theory respecting the Kahui Tepua. By James W. Stack.

Pronouns and other barat fossil words compared with primeval and non-Aryan languages of Hindostan and borders. By J. Turnbull Thomson.

Maori connection. J. Turnbull Thomson.

Asiatic Culture in America.—In No. 6, Vol. ix of the *Canadian Naturalist,* Prof. John Campbell, of Montreal, attempts to connect the Basques of Europe, the Nubians of Africa, the Circassians, on the border of Europe and Asia, the Koriens, the Japanese and other peninsular people of Asia, the Aleutians, Kadiagmuts, Dakotas, Iroquois, Cherokee-Choctaws, Muyscas, Peruvians, and Chilenos of America. The author sets out from the labors of Hyde Clarke, "to whom," it is said, "belongs the most of the discovery which bids fair to revolutionize the science of ethnology." The paper certainly exhibits a vast amount of patient research; but, after all, we fail to see in many of the words enough of resemblance to prove identity.

A New Periodical.—On the 3d of July, 1880, the first number of a periodical with the title of *Science* was issued in New York, under the editoral charge of Mr. John Michels. Several valuable anthropological papers have appeared in its columns: Fragmentary notes on the Eskimo of Cumberland sound, by Ludwig Kumlien; Reports of Ethnological papers at the American Association, and notes scattered here and there on a variety of subjects. On page 205 is given Major Powell's vice-presidential address on the Wyandotte government before the American Association.

Skin Furrows of the Hand.—New anatomical characters are being brought constantly within the anthropological area. Only a few months ago the relative length of the ring-finger and the fore-finger was added to the list of marks for observers. Mr. Henry Faulds of Tsukipi Hospital, Tokio, Japan, has commenced in *Nature,* of October 28th, a series of papers on the ethnological value of careful observations relating to the finger marks on ancient pottery, to those of criminals, and of the anthropoid apes.

Ethnography of the Caucasus.—One of the neatest pieces of ethnographic work which it has been our good fortune to inspect is a paper in No. ix of *Petermann's Mittheilungen,* on the abovementioned subject, prepared by N. v. Seidlitz. The article is made up chiefly of tables of statistics upon the almost hopelessly mixed Indo-European, Caucasic and Mongolian peoples of this region. A colored map exhibiting the tribal distribution will be found at the end of the number.

Population of the Earth.—The sixty-second Supplement of *Petermann's Mittheilungen* contains Behm and Wagner's "Die Bevölkerung der Erde, vi." Although the greater part of this pamphlet of x—132 pages belongs to the statisticians, the ethnologist will find enough material for comparative study to make it worth his while to give it his attention.

German Anthropology.—The stenographic report of the eleventh annual meeting of the German Society of Anthropology, Ethnology and Prehistory in Berlin, August 5 to 11, is a quarto pamphlet of 160 pages. Unfortunately, there is no index, excepting a catalogue of names unaccompanied with the titles of papers.

Corrections.—Our regret at making mistakes is only equaled by our happiness in making amends. In the list of papers read before the Washington Anthropological Society (page 813) please insert "The old Roman Senate: a study in the comparative history of assemblies," by J. Howard Gore. The notes on Japanese mythology (page 902) were sent by some unknown friend, and not by Professor E. S. Morse. In speaking of Dr. Yarrow's "Mortuary Customs" (page 904), credit was not given him for distinguishing between inhumation within the cabin, wigwam or house, and simple abandonment of a lodge containing a dead body. The closing chapter on mourning, feasts, food, dances, songs, games, etc., connected with burial, was omitted from the reference to the contents of the volume.

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GEOLOGY AND PALÆONTOLOGY.

GEOLOGY OF SOUTHEASTERN PENNSYLVANIA.—In a previous number of this magazine, we have noted the salient points of Prof. Frazer's report on the geology of York county, Pa. We have now before us his complete report on that of Lancaster county, and understand that that relating to Chester county is in course of preparation. The maps of York and Lancaster counties accompany the volumes, and that of Chester has already been prepared. Extensive additions to and corrections of the existing map by Rogers have been made by Prof. Frazer, although the map of the First Geological Survey remains intact in its principal features, and maintains itself as the best one of its time published in the country. A comparison of this map with the new one by Prof. Frazer shows the following new points in the latter:

(1.) The definition of the Eozoic, Chlorite Schist, and Roofing Slate areas, which were confounded or omitted in the old map. (2.) The connection between the Chester and Pequea Valley areas of the Lancaster Limestone, previously represented as distinct. (3.) The discrimination of several tracts of the Eozoic within the territory of the Chickis quartzite. (4.) The discovery of a trap dyke twenty miles in length, traversing the Eozoic and Siluro-Cambrian beds from N. E. to S. W. (5.) The correct determinations of the trap dykes of the Jura-Trias region.

The report on mining industries and resources is very full, occupying nearly half the volume. The report on the Gap nickel mine of Bart township will attract attention. This industry, built up by the energy and perseverance of Joseph Wharton, of Philadelphia, has assumed large proportions, the production of nickel being in excess of the consumption in the United States, leaving a surplus for export. Prof. Frazer shows that the metal is found chiefly as Millerite, encrusting masses of hornblende, which lie in the Eozoic gneiss.

A number of excellent engravings illustrate Prof. Frazer's report. Of the accompanying sections that exposed on the east bank of the Susquehanna river is the most extensive and instructive. As published, it represents an extensive anticlinal near the mouth of Tocquan creek, which is an important key to the relations of the rocks to the north and south of it. We would have been glad to have seen on this chart several other explanations of rock structure which appeared on the section as originally prepared by Prof. Frazer, but which were unfortunately omitted in publication. Many of the observed dips have also been erased, and figures pointing into the air substituted by the direction of the survey. The merits of this change are not obvious, since it renders incomprehensible what was previously clear to the eye.

Alleged changes in the relative elevation of Land and Sea.—The view that the north-eastern coast of North America is slowly rising, and Professor Shaler's estimate of the rate as being probably over a foot a century, and perhaps as much as three feet, has been negatived by Mr. Henry Mitchell, according to the *American Journal of Science and Arts*, who states in the Coast Survey Report for 1877, that the rocks upon our coast, long notorious as dangerous to navigation, have not risen since they were first discovered, while the salt marshes are still as in the time of the early explorers at ordinary high-water level, He claims that no tilt in either direction has taken place in the Gulf of Maine. But east of long. 64° 13′, "and especially in Newfoundland, great changes present themselves in the comparison of charts, the depths appearing to be at some points less and at other points greater now than formerly."

Catalogue of Vertebrata of the Permian Formation of the United States.

PISCES.

CROSSOPTERYGIA.

Ectosteorhachis Cope; Pal. Bull., No. 32, 1880, p. 19.
1. *E. nitidus* Cope; l. c. Texas.

DIPNOI.

Ctenodus Agass.
2. *C. fossatus* Cope; Proc. Amer. Phil. Soc. 1877, p, 54. Eastern Illinois.
3. *C. gurleianus* Cope; l. c., p. 55. Eastern Illinois.
4. *C. periprion* Cope; Proc. Amer. Phil. Soc. 1878, p. 527. Texas.
5. *C. porrectus* Cope; l. c. Texas.
6. *C. dialophus* Cope; l. c. p. 528. Texas.
7. *C. pusillus* Cope; Proc. Amer. Phil. Soc., 1877, p. 191. Eastern Illinois.

Ptyonodus Cope; Proceed. Amer. Philos. Soc. 1877, p. 192.
8. *P. vinslovii* Cope; Proc. Acad. Philada. 1876, p. 410. Eastern Illinois.
9. *P. paucicristatus* Cope; Proc. Amer. Phil. Soc. 1877, p. 54. Eastern Illinois.

SELACHII.

JANASSA Münst.
10. *J. gurleiana* Cope; Proc. Amer. Phil. Soc. 1877, p. 191. Eastern Illinois.
11. *J. strigilina* Cope; *S. linguæformis* Cope; l. c. p. 53, not of older authors. Eastern Illinois.
12. *J. ordiana* Cope; Texas.

DIPLODUS Agass.
13. *D. ? compressus* Newb. Eastern Illinois.
14. *D. sp.* Texas.

ORTHACANTHUS Agass.
15. *O. gracilis* Newberry. Eastern Illinois.
16. *O. quadriseriatus* Cope; l. c. p. 192. Eastern Illinois.

BATRACHIA.

STEGOCEPHALI.

GANOCEPHALA Owen, Cope (emend.) Amer. Natur. 1880, p. 60.

ERYOPS Cope; Proc. Amer. Phil. Soc. 1877, p. 188.
17. *E. megacephalus* Cope; l. c. Texas.

TRIMERORHACHIS Cope; Proc. Amer. Phil. Soc. 1878, p. 524.
18. *T. insignis* Cope; l. c. Texas.

ZATRACHYS Cope; l. c. p. 523.
19. *Z. serratus* Cope; l. c. Texas.

PARIOXYS Cope; l. c. p. 521.
20. *P. ferricolus* Cope; l. c. Texas.

PANTYLUS Cope; Bull. U. S. Geol. Surv. Terr. 1881 (80).
21. *P. cordatus* Cope; l. c. Texas.

EMBOLOMERA Cope, American Naturalist, 1880, p. 510.

CRICOTUS Cope; Proceed. Acad. Phila. 1876, p. 405.
22. *C. gibsoni* Cope; Proc. Amer. Phil. Soc. 1877, p. 185. Eastern Illinois.
23. *C. heteroclitus* Cope; Proc. Acad. Philada., 1876, p. 405. Eastern Illinois; Texas.

REPTILIA.

THEROMORPHA Cope; American Naturalist, 1878, p. 829.

PELYCOSAURIA Cope; l. c.

Diplocaulidæ.

DIPLOCAULUS Cope; Proc. Amer. Phil. Soc. 1877, p. 187.
24. *D. salamandroides* Cope; l. c. Eastern Illinois.

Clepsydropidæ.

PARIOTICHUS Cope; Proc. Amer. Phil. Soc. 1878, p. 508.
25. *P. brachyops* Cope; l. c. Texas.

ECTOCYNODON Cope; l. c.
26. *E. ordinatus* Cope; l. c. Texas.

ARCHÆOBELUS Cope; Proc. Amer. Phil. Soc. 1877, p. 192.
27. *A. vellicatus* Cope; l. c. Eastern Illinois.

CLEPSYDROPS Cope; Proc. Acad. Philada. 1876, p. 404.
28. *C. collettii* Cope; l. c. p. 407. Eastern Illinois.
29. *C. vinslovii* Cope; Proc. Amer. Phil. Soc. 1877, p. 62. Eastern Illinois.
30. *C. pedunculatus* Cope; l. c. p. 63. Eastern Illinois.
31. *C. natalis* Cope; Proc. Amer. Phil. Soc. 1878, p. 509. Texas.

DIMETRODON Cope; Proc. Amer. Phil. Soc. 1878, p. 512.
32. *D. incisivus* Cope; l. c. Texas.
33. *D. rectiformis* Cope; l. c. p. 514. Texas.
34. *D. biradicatus* Cope; Bull. U. S. Geol. Surv. Terrs. 1880 (81).
35. *D. gigas* Cope; l. c. p. 515. Texas.
36. *D. cruciger* Cope; Amer. Natur. 1878, p. 830. Texas.

THEROPLEURA Cope; Proc. Amer. Phil. Soc. 1878, p. 519.
37. *T. retroversa* Cope; l. c. Texas.
38. *T. uniformis* Cope; l. c. Texas.

39. *T. triangulata* Cope; l. c. p. 520. Texas.
40. *T. obtusidens* Cope; Pal. Bull. No. 32, 1880, p. 4. Texas.

Metarmosaurus Cope; Proc. Amer. Phil. Soc. 1878, p. 516.
41. *M. fossatus* Cope; l. c. Texas.

Embolophorus Cope; l. c. p. 518.
42. *E. fritillus* Cope; l. c. Texas.

Lysorophus Cope; Proc. Amer. Phil. Soc. 1877, p. 187.
43. *L. tricarinatus* Cope; l. c. Eastern Illinois.

Bolosauridæ.

Bolosaurus Cope; Proc. Amer. Phil. Soc. 1878, p. 506.
44. *B. striatus* Cope; l. c. Texas.

Diadectidæ Cope; Pal. Bull. No. 32, 1880, p. 8.

Diadectes Cope; Proc. Amer. Phil. Soc. 1878, p. 505.
45. *D. sideropelicus* Cope; l. c. Texas.
46. *D. phaseolinus* Cope; Pal. Bull. No. 32, 1880, p. 9. Texas.

Empedocles Cope; Proc. Amer. Phil. Soc. 1878, p. 516.
47. *E. alatus* Cope; l. c. Texas.
48. *E. latibuccatus* Cope; l. c. Texas.
49. *E. molaris* Cope; Pal. Bull. No. 32, 1880, p. 10. Texas.

Helodectes Cope; Pal. Bull. 11, No. 32, p. 11.
50. *H. paridens* Cope; l. c. Texas.
51. *H. isaaci* Cope; l. c. p. 12. Texas.

Synopsis.

Pisces			15
Crossopterygia		1	
Dipnoi		8	
Selachii		7	
Batrachia			7
Stegocephali		7	
Ganocephala	5		
Embolomera	2		
Reptilia			28
Theromorpha		28	
Pelycosauria	28		
Total number of species			51

—*E. D. Cope.*

Geological News.—Professor Gaudry has recently obtained from the Permian of Igornay in Central France, the bones of a Theromorphous reptile of considerable size. He regards it as an ally of the carnivorous forms which have been discovered in Texas, Russia, etc., and names it *Stereorhachis dominans.*—— Professor Cope describes in the current number of Hayden's *Bulletin* a new carnivorous saurian from the Permian of Texas, in which the roots of some of the teeth are so deeply grooved as to be almost double. He names it *Dimetrodon biradicatus.*—— The deposit of chloride and bromide of silver at Leadville, Colorado, proves to be more extensive east of the city than has been supposed. Strikes of great richness have been made in the Denver City, near the R. E. Lee; the Scooper, the Leavenworth and the Sovereign, the latter nearly a mile east of the Lee.—— M. Daniel de Cortazar of the Geological Survey of Spain, has examined the geology of the Province of Toledo, and has published a geological map. The river Tagus, which traverses the province from east to west, flows through a wide band of diluvium, which is bordered on each side by other formations. These are, to the east, miocene and eocene; west of this, granite and gneiss. To the south there are extensive areas of silurian and cretaceous. The map is a handsome piece of engraving, but is on a small scale.

GEOGRAPHY AND TRAVELS.[1]

THE EAST CENTRAL AFRICAN EXPEDITION OF THE ROYAL GEOGRAPHICAL SOCIETY.—At the meeting of the Royal Geographical Society, held November 8, 1880, Mr. Joseph Thomson, the leader of this expedition, read an account of his explorations including many previous details not previously known.

The lofty plateau extending round the northern and eastern sides of Lake Nyassa and reaching half way to Tanganyika rises from 6000 to 9000 feet, and is so cut up by denudation as to appear like a series of mountains. "It consists to the north and west of metamorphic clay slates, with here and there felspathic rocks intruding, while immediately round Nyassa the rocks are purely volcanic porphyrites and tuffs. The difference in the external surface of this plateau has determined to a very marked extent the surface outlines produced by denudation. Thus the mountains of clay slate are distinguished by rounded grassy forms, generally smooth and uncut, uniform in shape and color, and by no means picturesque. Pass from these to the volcanic rocks, and we observe at once a marked change. We have sharp jagged peaks, precipitous rocky sides, notched and cut in the most irregular and striking fashion, as becomes mountains formed of such diverse materials as compact lava beds and loose tuffs and agglomerates. Add to these features huge yawning gorges and great precipices where vegetation in vain attempts to grow, and some notion of this plateau may be formed."

On this high tract of land were found most miserable and degraded types of the Negro race. "These people have dark, sooty skins, prognathous jaws and thick lips, with small heads and shrunk-up withered bodies which speak of an existence of the most miserable character. They go, as a rule, perfectly naked, and live in conical huts seven feet high and five or six feet in diameter, crawling in and out through a hole." "It was found almost impossible to communicate with them, as they seemed to be entirely devoid of any abstract ideas, and appeared to be completely shut off from all knowledge and communication with the outside world." "Mr. Thomson," remarks the *Academy*, "seems to have formed the idea that these tribes are in their present condition from having remained absolutely isolated; but others may incline to the opinion that it is a case of gradual degeneration."

The commercial importance of this portion of Central Africa is

[1] Edited by ELLIS H. YARNALL, Philadelphia.

not great. "Nowhere," says Thomson, "have I seen a single metal in a form which a white man would for a moment look at as a profitable or workable speculation. There is, no doubt, a considerable abundance of iron in many parts, but very little more than sufficient to supply the simple wants of the natives. Coal I saw none, and my researches would lead me to believe that such a thing does not exist over the wide area embraced by our route." "The chief characteristic of this part of the country was its utter barrenness and the absence of anything worth trading for."

The expedition marched for six days along the Lukuga, the outlet of Lake Tanganyika and which pursued its tumultuous course in a W. N. W. direction "through one of the most charming valleys I have ever seen in Africa; beautifully wooded hills rising on each side from 600 to 2000 feet above the level of the lake, while forest clumps and open glades diversified the scenery along the river's banks, where antelopes and buffaloes grazed in abundance." The refusal of his men to go further prevented Mr. Thomson's following the river to its junction with the Congo.

While there is much beauty and picturesqueness in the scenery along the shores of Tanganyika one is on the whole, disappointed in its monotony. There was the same unvarying tint of green, the same unbroken hill-ranges which would have been inexpressibly dreary but for the frequent appearance of a jutting cape or small island. The chief feature in the scenery was the immense boulders and blocks which everywhere lined the shore."

On the return to the coast, Lake Hikwa was visited. "We saw it from an altitude of about 8000 feet above the sea, its surface lying more than half that height beneath us, and the mountains rose in such perfect precipices all round, that it seemed as if we could throw a stone into it. One of its peculiarities is, that it has no visible outlet—a fact which admits of little doubt. From my own personal knowledge I can say that none exists either north, south or west, while Elton and Cotterill, in passing near its eastern side, found no stream flowing from that direction."

Of the one hundred and fifty men who started on this remarkable and most successful journey all but one reached the coast again, arriving in the best of health and condition after traversing no less than 2830 miles, of which 1300 were over entirely new ground.

African Exploration.—Dr. Emil Holub proposes to make a journey through Africa from the south to the north, starting from the borders of the British colonies and visiting first the Zambesi and the Marutse-Malunda country. Then crossing the watershed between the Zambesi and Congo he will explore the region around the sources of the latter river, after which he hopes to reach the utterly unexplored region north of the Congo and make his way through Darfur into Egypt. Dr. Holub anticipates accomplishing this extraordinary journey in the space of three years, at the cost of rather more than $25,000.——The French explorer, M. Savorgnan de Brazza, is again pursuing his explorations on the Ogowé, and at last accounts (July 14th) had started for the Congo after establishing a station at the junction of the Passa and Ogowé. His former companion, Dr. Ballay, is about to rejoin him, and the French section of the International Association sends out with him M. Mizon, who will establish a new station on the Ogowé. M. de Brazza had engaged 750 men for this latter expedition, who will ascend the Ogowé as far as the Alima, taking with them, in canoes, the sections of a steam launch.——Major von Mechow, who was sent out by the German Government eighteen months since to explore in Angola, left Malange on the 12th of June last, and arrived on the banks of Quango on the 19th of July, at a point below the great water falls, and considerably beyond the limits of Messrs. Ivens and Capello's explorations. Although the expedition was everywhere well received by the negroes, yet the hilly character, with its countless deeply-carved valleys, offered many obstacles to the transport of the goods and of the composite boat. For instance, the Cambo, a tributary of the Quango, which it joins between the two waterfalls, had to be crossed four times. The camp of the travelers, at the time of the despatch of the letter, was pitched below the falls, the more southern of which, called by the natives "Succambunda," now bears the name of the "Emperor William falls," while the northern one, called "Gombé," has been re-named the "Emperor Francis Joseph falls." The traveler intends to descend the Quango, which here is already very broad, in his boat as far as its junction with the Congo, and then to return. Everywhere the height above the sea-level was determined, and astronomical observations taken.——Two other Germans, Messrs. Pogge and Wissman, have also gone to Angola, in order to penetrate into the kingdom of the Muata Yanvo, whom Dr. Pogge visited in 1875.——Dr. Oscar Lenz, who was despatched by the same society in the latter part of 1879, has succeeded in reaching Timbuktu. He started from Tangier on December 22, 1879, in company of Hadj Ali, nephew of the celebrated Abd-el-Kader, and was disguised as a Turkish doctor of Constantinople. He met with a friendly reception at Timbuktu. He arrived at Medina, Senegal, on November 2, 1880. Of the three Europeans who have formerly visited Timbuktu, Major Lang (1826) was murdered; M. Réné Caillié two years later brought the first accounts of it to Europe, and Dr. Barth, in 1853–4, spent some months there.

MICROSCOPY.[1]

FERTILIZATION BY MEANS OF POLLEN-TUBES.—Mr. J. Kruttschnitt, of New Orleans, has been engaged for some years in the study of the pollen of flowers, the formation and history of the pollen-tube and its relation to the theory that each ovule is fertilized by a tube which descends from the stigma, reaches the ovule and enters its structure through the micropyle. His conclusion that this theory is radically erroneous, and that the functions of the pollen-tubes need re-examination, derives its force from the fact that, being an experienced, cautious and thoroughly capable observer, he has enjoyed exceptional opportunities for the study of the subject in plants most suitable for the purpose, and that the uniform result of his numerous experiments has been contradictory to the accepted theory. During the past few years he has examined thousands of cases, and has confirmed his observations in some 500 instances by mounted specimens, which show with great clearness the facts as they existed at the time of cutting the sections. Yet he has seen no pollen-tubes in contact with the ovules, nor anywhere near them, though examined during the times when fertilization must be taking place, if at all. On the contrary, the pollen-tube is always lost sight of near the stigma. The length of the style is such in many flowers that the pollen-tube would have a long way to travel to reach the ovule, and the arrangement of tissue is often such that nature would seem to have placed the greatest difficulties possible in the way of fertilization, instead of taking such a direct and certain way as would reasonably be expected. Mr. Kruttschnitt, therefore, concludes that it is next to impossible for fertilization to take place by the pollen-tube coming into actual contact with the ovules, and that, in fact, the whole ovary is impregnated with the substance of the pollen. He seems to suspect that wooden fibers or spiral ducts, leading in many cases directly toward the ovule, have been formerly mistaken for pollen-tubes. All these features are exquisitely shown in a special box of preparations just contributed to the Postal Club.

As to the general proof of the new theory, it must be admitted that the evidence is mostly negative, and that negative is at best a poor off-set for positive proof. That one man, however capable and thorough, has not seen a thing is overbalanced a thousand times by the fact that another capable and candid observer has seen it. The first may have taken the chances however small, which missed seeing that which did exist, the second could not really have seen that which did not exist. Still further observations, therefore, extending over a greater length of time, will be required to shake belief in a theory which has been so long regarded as a fact, and which rests upon the most positive and universally believed statements of fact. On the other hand it

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

must be admitted that so capable an observer, with unlimited opportunities for favorable observation, would be extremely likely to see the pollen-tubes at or near the ovules, if they really were accustomed to reach that locality; also, that there might be danger of mistaking other structures for pollen-tubes at a distance from the stigma, that the difficulties to be encountered by the pollen-tube in reaching the ovule would be very great in many cases, and that it would be almost a miracle if all the seeds of some plants having a vast number of ovules should be fructified individually by separate grains of pollen. It should also be remembered that the statement of early observers are often handed down as facts, without verification, by subsequent writers, and that proof of such a theory as that of the fructification of the ovule directly by the pollen may seem stronger than it is, a great number of statements to that effect resting (possible) on a much more limited number of really independent statements. The early observations, too, which established the accepted theory, must have been made with lenses of inferior defining power and without the advantages of staining, which would now render error much more improbable. Furthermore pollen-tubes may in some instances have really been seen in contact with the ovules, and a general theory have been drawn from the fact, when their presence there was exceptional and not normal, or at least not general. The proof of the old theory is therefore not so positive as it seems; and the theory must be to some extent an assumption founded upon facts whose significance is not beyond dispute.

Though analogy is often an unsafe argument, the doctrine of fertilization of the whole ovary by the pollen is well illustrated, to say the least, by the ferns and others among the lower plants which produce fertile spores indefinitely as the result of a single earlier fructification. On the whole, while far more proof will be required to convince the world of the correctness of the new theory, still the very interesting and able studies of Mr. Kruttschnitts seem sufficiently conclusive to call for a reconsideration of the old theory, or at least, for a revision of the proofs upon which it rests.

AMERICAN MICROSCOPICAL SOCIETY OF THE CITY OF NEW YORK.—Owing to a misapprehension which appears to have been recently encouraged by interested parties, friends of the American Microscopical Society of the City of New York—the oldest incorporated Microscopical Society in the United States—are notified that the name of the Society *has not been changed, its meetings discontinued, or its large and valuable collection broken up and scattered.* At the recent annual election the following officers were elected for the year 1880: President, John B. Rich, M. D.; secretary, O. G. Mason, Bellevue Hospital.

SCIENTIFIC NEWS.

— The National Academy of Sciences held a meeting, November 16th–19th, for the reading of papers by its members at New York. From the annual report of the president, Prof. W. B. Rogers, we take the following statement, showing the practical nature of the work already performed by the members for the Government, and who are elected solely from the excellence of their original contributions to pure science.

The National Academy of Sciences was established by Act of Congress in March, 1863, with power to frame its own constitution, select its own members, and provide in other respects for its continuance and successful operation.

The object of the Academy is to advance science, pure and applied, by original researches; to invite the attention and aid of the Government to scientific inquiries of especial public importance, to be directed by the Academy; and especially to investigate, examine, experiment, and report on any subject of science or art whenever called upon by any department of the Government.

The Academy contains at present about one hundred members, representing within their ranks nearly every department of knowledge, whose services, in accordance with the charter of the Academy, are always at the disposal of the Government.

The Academy by its charter is made in a sense the scientific adviser of the National Government, and has, therefore, been frequently called upon by the departments for suggestions or researches on scientific questions bearing upon the public interest.

The Report gives a summary of what the Academy has done since its foundation in aiding the Government by its scientific advice and coöperation. The special investigations thus undertaken amount in number to thirty-one, on such subjects as the magnetic deviations in iron ships, the national currency, the expansion of steam, the prevention of counterfeiting, the improvement of Greytown harbor, Nicaragua, the distinguishing of calf's hair goods from woolen goods, silk culture in the United States, the measurement of the velocity of light, the preparation of a magnetic chart of the United States, and similar subjects, together with reports on weights, measures and coinage.

As the Report states: "A consideration of the value of these labors, and of the prompt zeal with which the Academy has always responded to the calls of the Government, should incline the National Legislature to continue the wise policy of making ample provision for the scientific work undertaken by the Academy at the request or with the sanction of the Government. Researches of the nature of some of those here enumerated, require costly instruments and the coöperation of many persons, it may be for a prolonged period, and, of course, cannot be brought to the most satisfactory results without an expenditure of money corresponding to the nature and duration of the work.

"It is much to be regretted that the Academy is not provided with the means of publishing its scientific and other productions. Since its establishment, upward of five hundred papers, many of them possessing great scientific value, have been contributed by its members and by others who have been invited to take part in its sessions. Some of these, it is true, have reached the circle of scientific readers through other channels of publication, but it cannot be doubted that the interests of science, as well as the dignity of the Academy, would be promoted by the annual publication of a volume of its scientific memoirs and other proceedings under its own direction and authority.

"As a recognized counselor of the Government, frequently called upon for important scientific service, it is thought that the Academy may reasonably hope that provision will be made by the Government for such publication."

— As a result of the explorations of the United States Fish Commission within the past ten years, 1000 additions to the Maine invertebrate fauna of New England have been made; many of them, however, have been independently discovered by Prof. Verrill, who also has had charge of these explorations undertaken by the Commission. Moreover, the Commission has discovered one hundred species of fish near to the eastern Atlantic coast, of which about fifty are new to science. One of the more important features of the work is the preparation of life-histories of the useful marine animals of the country. More or less complete biographical monographs have been printed on the blue-fish, scup, menhaden, salmon, and the white fish, and others are nearly ready. The embryological history of the cod, shad, alewife, salmon, smelt, Spanish mackerel, striped bass, white perch, and the oyster have been studied, under the auspices of the Commission, by Messrs. Brooks, Ryder, Schaeffer, Rice and others. A pleasant tribute to the success of the Commission in its general work and its exhibit at the Berlin International Exhibition was the award of the first honorary prize by the Emperor of Germany to Prof. Baird, who is regarded in Europe, in the words of the president of the German Fischerei Verein, as the first fish culturist in the world.

— The steamer *Blake*, Commander J. R. Bartlett, U. S. N., Assistant Coast and Geodetic Survey, under instructions from C. P. Patterson, superintendent of that survey, lately read a paper on a dredging trip of three or four weeks off the coast between George's bank and the latitude of Savannah. The lines dredged over, approved by the superintendent, were those selected by

Prof. A. Agassiz, who accompanied the *Blake*, having special charge of the results of the dredgings, all of which proved to be eminently satisfactory to him, many new forms and facts being obtained. In effecting the dredgings, over a line off Charleston, S. C., nearly normal to the coast, across the Gulf stream, Commander Bartlett found the depths much less than expected. This induced him, although the trip was one primarily for dredging, to extend the work of sounding, and he accordingly ran a line of soundings nearly along the warmest band of the Gulf stream, commonly called the axis of the stream, for a distance of 150 miles, from lat. 32m. to lat. 33m. 30s. north, on which he obtained depths varying from 233 to 450 fathoms, where it was supposed that the depths would range from 600 to 1000 fathoms. At the north-east end of this line, in about lat. 33° 30′ north, the depth suddenly increased, in a distance of 15 miles, from 457 to 1386 fathoms. These depths obtained by Commander Bartlett, appeared to indicate that a submarine table land may extend from the coasts of North and South Carolina across to the Northern Bahamas.

— Lieutenant-Commander Sigsbee's gravitating trap for collecting organisms at different depths, was described by Prof. Agassiz, at the last meeting of the National Academy of Sciences, who also reviewed the more important results determined by its use. It was found that to the depth of 50 fathoms the same organisms were taken as at the surface. The next 50 fathoms contained the same types, but the genera was less numerous. They counted 17 genera of pelagic organisms upon the immediate surface in one of these investigations, but only 5 of them were brought up when the trap was let down to a depth of 100 fathoms. Prof. Agassiz concluded with a high compliment to the ingenuity of Commander Sigsbee, whose invention had surmounted so many of the difficulties connected with the study of submarine biology.

He believed that the bodies of pelagic organisms brought up from great depths were the carcasses of animals that had perished of age or accident upon the surface, and had slowly settled to the bottom to furnish food for its living hosts. It required from three to four days for a dead tunicate to sink to the depth of 1000 fathoms.

— Many sheep and lambs have recently been worried on sheep farms in the neighborhood of Dundee, Scotland. An unusual method of sheep worrying was recently perpetrated on the farm of Pickstone, tenanted by Mr. Campbell. One morning a lamb was heard bleating in one of the fields on the farm, and, as no lamb could be seen on a casual inspection, a more careful search was made, when it was found that the bleating proceeded from a lamb that was buried in the land, the only part left exposed being the head. It was at once evident that this had been the work of a dog. The lamb was taken out, and was, strange to say, little the worse of its burial. A diligent watch was instituted, with the result that the depredator—a collie dog—was captured in the act of burying another lamb, which was also alive.

— The new building at South Kensington for the British Museum was finished last June, and the geological, botanical and mineralogical specimens have been removed from the old building. The zoölogical collections, which are equal in bulk to the other three collectively, have yet to be removed, as the necessary funds for this purpose have not yet been appropriated. Professor Owen, the veteran Superintendent of the Natural History Collection, still actively directs the labors of his assistants. A biographical notice of Professor Owen and an excellent portrait by Jeens appeared in *Nature*. He has lately designed an index museum in the new building, intended "to show the type characters of the principal groups of organized beings," thus epitomizing nearly the entire museum.

— The members of the expedition which, under the auspices of the Archæological Institute of America, is to investigate the ruins of the city of Assos, in Asia Minor, will sail this week in the steamship *Germanic*, of the White Star Line. The party comprises Joseph Thatcher Clarke, of Boston, who will act as the leader; Francis Henry Bacon, of this city; Maxwell Wrigley, of Brooklyn, and two or three other gentlemen who are interested in archæological research. Through the Department of State, the Turkish Government has offered the members of the expedition every assistance in its power. Assos is on the southern coast of Mysia, opposite the island of Lesbos, and contains among other things the ruins of a Doric temple, a theatre, and massive fortification walls.

— The following calculation as to the total number of existing botanical species, has been recently made by Dr. Müller, of Geneva. We have at present in our books about 130,000 species, and if we suppose that 30,000 (in round numbers), belong to countries like Europe and North America, where there are hardly any species, but some cryptogams to be discovered, the remainder, or 100,000, representing exotic plants, more or less tropical and southern, we may double the latter for new species, giving 200,000 for these less known regions, and altogether 230,000 for the whole globe, with the exception of countries still quite unknown botanically. Adding only 20,000 species for the latter, we reach a minimum sum of 250,000 species of plants.

— Dr. B. W. Richardson, in a paper read before the Sanitary Institute (Exeter, September 20, 1880), seems to approach the position of Professor Jäger. He writes: "Go into the wards of a lunatic asylum, and notice among the most troubled there the odor of the gases and the vapors they emit by the skin and the breath. That odor is from their internal atmosphere, their nervous ethereal emanation. They are mad up to suicide or murder, or any criminal folly. Can it be otherwise? They have secreted the madness; they are filled with it; it exhales from them. Catch it, condense it, imbibe it, and in like manner it would madden any one." Is not this the teaching of Jäger and Dunstmaier, spiced to suit the audience and the occasion?—*Journal of Science.*

— M. E. Yung (*Comptes Rendus*, August 30, 1880) has studied the development of the eggs of *Loligo vulgaris* and *Sepia officinalis* exposed to light of different colors. The development is hastened by violet and blue light; retarded by green and red. Yellow light behaves like white light. Larvæ of *Ciona intestinalis* also grew most rapidly in the violet light. Development under the red and green lights, though retarded, was effected in perfection.

— Besides issuing the beginning of what will be a most valuable series of monographs on the Mediterranean fauna studied at Dr. Dohrn's Zoölogical Station, a provisional priced catalogue of the microscopical preparations issued by the Station at Naples, has been published. It includes four different preparations of Protozoa, 33 of Cœlenterata, 49 of Echinodermata, 33 of Vermes, 57 of Arthropoda, 54 of Mollusca, and 193 of Vertebrata. These will be as valuable as any ever sold. The price is from one to ten francs.

— As the result of Dr. O. Finsch's voyage of ten months in the Pacific Ocean he has sent to Europe about thirty boxes of collections, the materials embracing 70 mammals, 180 birds, 800 reptiles, 1200 fishes, 15,000 mollusks, 800 crustacea, 400 spiders, 1400 insects, together with 50 skulls and 55 casts of faces, representing the people of twenty different islands, besides 1500 ethnographical objects.

— A Young Men's Society for Home Study has been formed in Boston for the encouragement of systematic study and reading at home. The course in Natural Science, of which department Mr. S. H. Scudder is the head, embraces Botany, three courses in Zoölogy and two courses in Geology. The reading is designed to be accompanied by the study of specimens.

— We learn that the Rev. W. H. Dallinger, of Liverpool, the distinguished microscopist, has accepted the appointment of Governor and Professor of Biology at Wesley College, Sheffield. This institution may be congratulated on the acquisition it has made.

— The death of Mr. Frank Buckland, is announced in the papers of Dec. 18th. Mr. Buckland was the son of Dean Buckland, the distinguished geologist. He was well known as a pleasing writer on popular natural history, and as a fish culturist.

— A large and valuable collection of Rhode Island plants has been presented by Mr. James L. Bennett, of Providence, to the already increasing Herbarium of Brown University, of which Mr. W. W. Bailey has recently been appointed the curator.

— Prof. Thomas Rymer Jones, F.R.S., died in December; he was born in 1810; held the chair of comparative anatomy in King's College, London, and was the author of "The General Outline of the Animal Kingdom."

— Dr. E. Sequin, well-known as a leading American physician, philanthropist and physiologist, died in New York in October. He was born in France in 1812, and showed brilliant talents while a student in Paris.

— It is stated in the daily papers that the late Prof. Watson, of the University of Michigan left the sum of $50,000 to the National Academy of Sciences for the promotion of original research in astronomy.

— It is reported in the daily papers that a manuscript journal of Gilbert White, of Selborne, has been discovered. It is said to be of considerable length.

— Dr. Lauder Lindsay, who wrote on the subject of intelligence in the lower animals, and who was an authority on British lichens, died in December last.

— Prof. Ernst Hampe, a distinguished German bryologist, died recently at Helmatedt, aged 85 years.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

New York Academy of Sciences, Dec. 20.—Professor C. H. Hitchcock read a paper on the ancient volcanoes of New England, and Dr. R. P. Stevens exhibited some rare silver ores and carboniferous fossils from Arizona.

Boston Society of Natural History, Dec. 15.—Notes on the geology of Mt. Desert were read by Mr. Wm. M. Davis, and that of the adjoining Frenchmen's Bay was discussed by Mr. W. O. Crosby. Mr. J. S. Kingsley spoke of some points in the anatomy of Holothurians. Dr. Edward Palmer showed some objects of ethnological interest from caves in Mexico.

APPALACHIAN MOUNTAIN CLUB, Dec. 10.—Mr. H. Murdock read a paper on Mt. Cardigan, including accounts of several ascents.

AMERICAN GEOGRAPHICAL SOCIETY, Dec. 23.—Mr. Thomas Davidson read a paper on the recent excavations and discoveries at Athens and Olympia.

MIDDLESEX INSTITUTE.—At an adjourned meeting of the *Middlesex Scientific Field Club*, held on the 8th of December, 1880, the name of the club was changed to that of *Middlesex Institute*, by which name it will hereafter be known.

BOSTON SOCIETY OF NATURAL HISTORY, Jan. 5, 1881.—Dr. M. E. Wadsworth discussed the appropriation of the name "Laurentian" by the Canadian Geological Survey. The President gave further details of the structure of the carboniferous millipedes, to show that they should be classed as a distinct suborder of Myriapods. Mr. F. W. Putnam exhibited some supposed Palaeolithic implements from Massachusetts, and spoke of their discovery and character. Mr. J. S. Kingsley presented a collection of Crustacea and remarked on some of its rare or curious species.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

GEOLOGICAL MAGAZINE.—December. Notes on the occurrence of Stone Implements in the coast latitude south of Madras, by R. B. Foote. Analysis of Moa egg-shell, by A. Liversidge. Classification of the Pliocene and Pleistocene beds, by C. Reid. The Mammoth in Siberia, by H. H. Howorth. (The writer maintains that in former times when the mammoth abounded in Northern Siberia, the climate of this region, extending from the Ural mountains to Behring straits, Siberia, was much milder and like that of Lithuania at present "where the bison still survives, and where so many of the other contemporaries of the mammoth still live.")

ANNALS AND MAGAZINE OF NATURAL HISTORY, November.—On the minute structure of the recent *Heteropora neozelanica*, and on the relations of the genus Heteropora to Monticulipora, by H. A. Nicholson. On *Stromatopora dartingtoniensis*, n. sp., with tabulation in the larger branches of the Astrorhiza, by H. J. Carter.

AMERICAN JOURNAL OF SCIENCE, January, 1881.—The Albany Granite, New Hampshire, and its contact phenomena, by G. W. Hawes.

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OBSERVATIONS ON THE SALMON OF THE PACIFIC.

BY DAVID S. JORDAN AND CHAS. H. GILBERT.

DURING the most of the present year, the writers have been engaged in the study of the fishes of the Pacific coast of the United States, in the interest of the U. S. Fish Commission and the U. S. Census Bureau. The following pages contain the principal facts ascertained concerning the salmon of the Pacific coast. It is condensed from our report to the U. S. Census Bureau, by permission of Professor Goode, assistant in charge of fishery investigations.

There are five species of salmon (Oncorhynchus) in the waters of the North Pacific. We have at present no evidence of the existence of any more on either the American or the Asiatic side.

These species may be called the quinnat or king salmon, the blue-back salmon or red-fish, the silver salmon, the dog salmon, and the hump-back salmon or *Oncorhynchus chouicha*, *nerka*, *kisutch*, *keta* and *gorbuscha*. All these species are now known to occur in the waters of Kamtschatka as well as in those of Alaska and Oregon.

As vernacular names of definite application, the following are on record:

a. Quinnat—Chouicha, king salmon, e'quinna, saw-kwey, Chinnook salmon, Columbia River salmon, Sacramento salmon. tyee salmon, Monterey salmon, deep-water salmon, spring salmon, ek-ul-ba ("ekewan") (fall run).

b. Blue-back—krasnaya ryba, Alaska red-fish, Idaho red-fish, sukkegh, Frazer's river salmon, rascal, oo-chooy-ha.

c. Silver salmon—kisutch, winter salmon, hoopid, skowitz, coho, bielaya ryba, o-o-wun.

d. Dog salmon—kayko, lekai, ktlawhy, qualoch, fall salmon, o-le-a-rah. The males of *all* the species in the fall are usually known as dog salmon, or fall salmon.

e. Hump-back—gorbuscha, haddo, hone, holia, lost salmon, Puget Sound salmon, dog salmon (of Alaska).

Of these species, the blue-back predominates in Frazer's river, the silver salmon in Puget sound, the quinnat in the Columbia and the Sacramento, and the silver salmon in most of the small streams along the coast. All the species have been seen by us in the Columbia and in Frazer's river; all but the blue-back in the Sacramento, and all but the blue-back in waters tributary to Puget sound. Only the quinnat has been noticed south of San Francisco, and its range has been traced as far as Ventura river, which is the southernmost stream in California which is not muddy and alkaline at its mouth.

Of these species, the quinnat and blue-back salmon habitually "run" in the spring, the others in the fall. The usual order of running in the rivers is as follows: *nerka, chouicha, kisutch, gorbuscha, keta.*

The economic value of the spring running salmon is far greater than that of the other species, because they can be captured in numbers when at their best, while the others are usually taken only after deterioration.

The habits of the salmon in the ocean are not easily studied. Quinnat and silver salmon of every size are taken with the seine at almost any season in Puget sound. The quinnat takes the hook freely in Monterey bay, both near the shore and at a distance of six or eight miles out. We have reason to believe that these two species do not necessarily seek great depths, but probably remain not very far from the mouth of the rivers in which they were spawned.

The blue-back and the dog salmon probably seek deeper water, as the former is seldom or never taken with the seine in the ocean, and the latter is known to enter the Straits of Fuca at the spawning season.

The great majority of the quinnat salmon and nearly all the blue-back salmon enter the rivers in the spring. The run of both begins generally the last of March; it lasts, with various modifications and interruptions, until the actual spawning season in November; the time of running and the proportionate amount of each of the subordinate runs, varying with each different river. In general, the runs are slack in the summer and increase with the first high water of autumn. By the last of August only straggling blue-backs can be found in the lower course of any stream, but both in the Columbia and the Sacramento the quinnat runs in considerable numbers till October at least. In the Sacramento the run is greatest in the fall, and more run in the summer than in spring. In the Sacramento and the smaller rivers southward, there is a winter run, beginning in December.

The spring salmon ascend only those rivers which are fed by the melting snows from the mountains, and which have sufficient volume to send their waters well out to sea. Such rivers are the Sacramento, Rogue, Klamath, Columbia and Frazer's rivers.

Those salmon which run in the spring are chiefly *adults* (supposed to be at least three years old). Their milt and spawn are no more developed than at the same time in others of the same species which will not enter the rivers until fall. It would appear that the contact with cold fresh water, when in the ocean, in some way caused them to turn toward it and to "run," before there is any special influence to that end exerted by the development of the organs of generation.

High water on any of these rivers in the spring is always followed by an increased run of salmon. The canners think, and this is probably true, that salmon which would not have run till later, are brought up by the contact with the cold water. The cause of this effect of cold fresh water is not understood. We may call it an instinct of the salmon, which is another way of expressing our ignorance. In general, it seems to be true that in those rivers and during those years when the spring run is greatest, the fall run is least to be depended on.

As the season advances, smaller and younger salmon of these two species (quinnat and blue-back) enter the rivers to spawn, and in the fall these young specimens are very numerous. We have thus far failed to notice any gradations in size or appearance of these young fish by which their ages could be ascertained. It is, however, probable that some of both sexes reproduce at the age of one year. In Frazer's river, in the fall, quinnat male grilse of every size, from eight inches upwards, were running, the milt fully developed, but usually not showing the hooked jaws and dark colors of the older males. Females less than eighteen inches in length were rare. All, large and small, then in the river, of either sex, had the ovaries or milt well developed.

Little blue-backs of every size down to six inches are also found in the Upper Columbia in the fall, with their organs of generation fully developed. Nineteen-twentieths of these young fish are males, and some of them have the hooked jaws and red color of the old males.

The average weight of the quinnat in the Columbia, in the spring, is twenty-two pounds; in the Sacramento about sixteen. Individuals weighing from forty to sixty pounds are frequently found in both rivers, and some as high as eighty pounds are reported. It is questioned whether these large fishes are: *(a.)* Those which, of the same age, have grown more rapidly; *(b.)* Those which are older but have, for some reason, failed to spawn; or *(c.)* Those which have survived one or more spawning seasons. All of these origins may be possible in individual cases; we are, however, of the opinion that the majority of these large fish are those which have hitherto run in the fall and so may have survived the spawning season previous.

Those fish which enter the rivers in the spring, continue their ascent until death or the spawning season overtakes them. Probably none of them ever return to the ocean, and a large proportion fail to spawn. They are known to ascend the Sacramento as far as the base of Mount Shasta, or to its extreme head-waters, about four hundred miles. In the Columbia they are known to ascend as far as the Bitter Root mountains, and as far as the Spokan falls, and their extreme limit is not known. This is a distance of six to eight hundred miles.

At these great distances, when the fish have reached the spawning grounds, besides the usual changes of the breeding season, their bodies are covered with bruises on which patches of white fungus develop. The fins become mutilated, their eyes are often injured or destroyed; parasitic worms gather in their gills, they become extremely emaciated, their flesh becomes white from the loss of the oil, and as soon as the spawning act is accomplished, and sometimes before, all of them die. The ascent of the Cascades and the Dalles probably causes the injury or death of a great many salmon.

When the salmon enter the river they refuse bait, and their stomachs are always found empty and contracted. In the rivers they do not feed, and when they reach the spawning grounds their stomachs, pyloric cœca and all, are said to be no larger than one's finger. They will sometimes take the fly, or a hook baited with salmon roe, in the clear waters of the upper tributaries, but there is no other evidence known to us that they feed when there. Only the quinnat and blue-back (then called red-fish) have been found in the fall at any great distance from the sea.

The spawning season is probably about the same for all the species. It varies for all in different rivers and in different parts of the same river, and doubtless extends from July to December.

The manner of spawning is probably similar for all the species, but we have no data for any except the quinnat. In this species the fish pair off, the male, with tail and snout, excavates a broad shallow "nest" in the gravelly bed of the stream, in rapid water, at a depth of one to four feet; the female deposits her eggs in it and after the exclusion of the milt they cover them with stones and gravel. They then float down the stream tail foremost. A great majority of them die. In the head-waters of the large streams all die, unquestionably. In the small streams, and near the sea, an unknown percentage *probably* survive. The young hatch in about sixty days, and most of them return to the ocean during the high water of the spring.

The salmon of all kinds in the spring are silvery, spotted or not according to the species, and with the mouth about equally symmetrical in both sexes.

As the spawning season approaches the female loses her silvery color, becomes more slimy, the scales on the back partly sink into the skin, and the flesh changes from salmon red and becomes variously paler, from the loss of the oil; the degree of paleness varying much with individuals and with inhabitants of different rivers.

In the lower Sacramento the flesh of the quinnat in either spring or fall is rarely pale. In the Columbia, a few with pale flesh are sometimes taken in spring, and a good many in the fall. In Frazer's river the fall run of the quinnat is nearly worthless for canning purposes, because so many are white meated. In the spring very few are white meated, but the number increases towards fall, when there is every variation, some having red streaks running through them, others being red toward the head and pale toward the tail. The red and pale ones cannot be distinguished externally, and the color is dependent neither on age nor sex. There is said to be no difference in the taste, but there is no market for canned salmon not of the conventional orange color.

As the season advances, the differences between the males and the females become more and more marked, and keep pace with the development of the milt, as is shown by dissection.

The males have: *(a.)* The premaxillaries and the tip of the lower jaw more and more prolonged, both of them becoming finally strongly and often extravagantly hooked, so that either they shut by the side of each other like shears, or else the mouth cannot be closed. *(b.)* The front teeth become very long and canine-like, their growth proceeding very rapidly, until they are often half an inch long. *(c.)* The teeth on the vomer and tongue often disappear. *(d.)* The body grows more compressed and deeper at the shoulders, so that a very distinct hump is formed; this is more developed in *O. gorbuscha*, but is found in all. *(e.)* The scales disappear, especially on the back, by the growth of spongy skin. *(f.)* The color changes from silvery to various shades of black and red or blotchy, according to the species. The blue-back turns rosy red, the dog salmon a dull, blotchy red, and the quinnat generally blackish.

These distorted males are commonly considered worthless, rejected by the canners and salmon-salters, but preserved by the Indians. These changes are due solely to influences connected with the growth of the testes. They are not in any way due to the action of fresh water. They take place at about the same time in the adult males of all species, whether in the ocean or in the rivers. At the time of the spring runs, all are symmetrical. In the fall, all males of whatever species are more or less distorted. Among the dog salmon, which run only in the fall, the males are hook-jawed and red-blotched when they first enter the Straits of Fuca from the outside. The hump-back, taken in salt water about Seattle, shows the same peculiarities. The male is slab-sided, hook-billed and distorted, and is rejected by the canners. No hook-jawed *females* of any species have been seen.

It is not positively known that any hook-jawed male survives the reproductive act. If any do, their jaws must resume the normal form.

On first entering a stream the salmon swim about as if playing: they always head towards the current, and this "playing" may be simply due to facing the flood tide. Afterwards they enter the deepest parts of the stream and swim straight up, with few interruptions. Their rate of travel on the Sacramento is estimated by Stone at about two miles per day; on the Columbia at about three miles per day.

As already stated, the economic value of any species depends in great part on its being a "spring salmon." It is not generally possible to capture salmon of any species in large numbers until they have entered the rivers, and the spring salmon enter the rivers long before the growth of the organs of reproduction has reduced the richness of the flesh. The fall salmon cannot be taken in quantity until their flesh has deteriorated; hence the "dog salmon" is practically almost worthless, except to the Indians, and the hump-back salmon is little better. The silver salmon, with the same breeding habits as the dog salmon, is more valuable, as it is found in Puget sound for a considerable time before the fall rains cause the fall runs, and it may be taken in large numbers with seines before the season for entering the rivers. The quinnat salmon, from its great size and abundance is more valuable than all other fishes on our Pacific coast together. The blue-back, similar in flesh but much smaller and less abundant, is worth much more than the combined value of the three remaining species.

The fall salmon of all species, but especially the dog salmon, ascend streams but a short distance before spawning. They seem to be in great anxiety to find fresh water and many of them work their way up little brooks only a few inches deep, where they soon perish miserably, floundering about on the stones. Every stream, of whatever kind, has more or less of these fall salmon.

It is the prevailing impression that the salmon have some special instinct which leads them to return to spawn in the same spawning grounds where they were originally hatched. We fail to find any evidence of this in the case of the Pacific coast salmon, and we do not believe it to be true. It seems more probable that the young salmon, hatched in any river, mostly remain in the ocean within a radius of twenty, thirty or forty miles of its mouth. These, in their movements about in the ocean, may come into contact with the cold waters of their parent rivers, or perhaps of any other river, at a considerable distance from the shore. In the case of the quinnat and the blue-back, their "instinct" leads them to ascend these fresh waters, and in a majority of cases these waters will be those in which the fishes in question were originally spawned. Later in the season the growth of the reproductive organs leads them to approach the shore and to search for fresh waters, and still the chances are that they may find the original stream. But undoubtedly many fall salmon ascend, or try to ascend, streams in which no salmon was ever hatched.

It is said of the Russian river and other California rivers, that their mouths in the time of low water in summer, generally become entirely closed by sand bars, and that the salmon in their eagerness to ascend them, frequently fling themselves entirely out of water on the beach. But this does not prove that the salmon are guided by a marvelous geographical instinct which leads them to their parent river. The waters of Russian river soak through these sand bars and the salmon "instinct," we think, leads them merely to search for fresh waters.

This matter is much in need of further investigation; at present, however, we find no reason to believe that the salmon enter the Rogue river simply because they were spawned there, or that a salmon hatched in the Clackamas river is any the more likely on that account to return to the Clackamas than to go up the Cowlitz or the Deschûtes.

"At the hatchery on Rogue river, the fish are stripped, marked and set free, and every year since the hatchery has been in operation some of the marked fish have been re-caught. The young fry are also marked, but none of them have been re-caught."

This year the run of silver salmon in Frazer's river was very light, while on Puget sound the run was said by the Indians to be greater than ever known before. Both these cases may be due to the same cause, the dry summer, low water and consequent failure of the salmon to find the rivers. The run in the sound is much more irregular than in the large rivers. One year they will abound in one bay and its tributary stream and hardly be seen in another, while the next year the condition will be reversed. At Cape Flattery the run of silver salmon for the present year was very small, which fact was generally attributed by the Indians to the birth of twins at Neah bay.

In regard to the diminution of the number of salmon on the coast. In Puget's sound, Frazer's river and the smaller streams, there appears to be little or no evidence of this. In the Columbia, river the evidence appears somewhat conflicting; the catch during the present year (1880) has been considerably greater than ever before (nearly 540,000 cases of 48 lbs. each having been packed), although the fishing for three or four years has been very extensive. On the other hand, the high water of the present spring has undoubtedly caused many fish to become spring salmon which would otherwise have run in the fall. Moreover, it is urged that a few years ago when the number caught was about half as great as now, the amount of netting used was perhaps one-eighth as much. With a comparatively small outfit the canners caught half the fish, now with nets much larger and more numerous, they catch them all, scarcely any escaping during the fishing season (April 1 to August 1). Whether an actual reduction in the number of fish running can be proven or not, there can be no question that the present rate of destruction of the salmon will deplete the river before many years. A considerable number of quinnat salmon run in August and September, and some stragglers even later; these now are all which keep up the supply of fish in the river. The non-molestation of this fall run, therefore, does something to atone for the almost total destruction of the spring run.

This, however, is insufficient. A well ordered salmon hatchery is the only means by which the destruction of the salmon in the river can be prevented. This hatchery should be under the control of Oregon and Washington, and should be supported by a tax levied on the canned fish. It should be placed on a stream where the quinnat salmon actually come to spawn.

It has been questioned whether the present hatchery on the Clackamas river actually receives the quinnat salmon in any numbers. It is asserted, in fact, that the eggs of the silver salmon and dog salmon, with scattering quinnat, are hatched there. We have no exact information as to the truth of these reports, but the matter should be taken into serious consideration.

On the Sacramento there is no doubt of the reduction of the number of salmon; this is doubtless mainly attributable to over-fishing, but in part it may be due to the destruction of spawning beds by mining operations and other causes.

As to the superiority of the Columbia river salmon; there is no doubt that the quinnat salmon average larger and fatter in the Columbia than in the Sacramento and in Puget sound. The difference in the canned fish is, however, probably hardly appreciable. The canned salmon from the Columbia, however, bring a better price in the market than those from elsewhere. The canners there generally have had a high regard for the reputation of the river, and have avoided canning fall fish or species other than the quinnat. In the Frazer's river the blue-back is largely canned, and its flesh being a little more watery and perhaps paler, is graded below the quinnat. On Puget sound, various species are canned; in fact, everything with red flesh. The best canners on the Sacramento apparently take equal care with their product with those of the Columbia, but they depend largely on the somewhat inferior fall run. There are, however, sometimes salmon canned in San Francisco, which have been in the city markets, and for some reason remaining unsold, have been sent to the canners; such salmon are unfit for food, and canning them should be prohibited.

The fact that the hump-back salmon runs only on alternate years in Puget sound (1875, 1877, 1879, etc.) is well attested and at present unexplained. Stray individuals only are taken in other years. This species has a distinct "run," in the United States, only in Puget sound, although individuals (called "lost salmon") are occasionally taken in the Columbia and in the Sacramento.

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THE SIPHONOPHORES.

II.—THE ANATOMY AND DEVELOPMENT OF AGALMA (CONTINUED).

BY J. WALTER FEWKES.

THE key to the zoölogical affinities of *Agalma*, the adult structure of which has been given in a previous article,[1] is to be found in its embryology or the development from the egg. To that subject I propose to devote the present article, as it is impossible in the case of this jelly fish, to discuss its morphological relationship from the study of anatomy alone.

In this discussion I shall consider, in the first place, the development of the *Agalma* from the egg, and in the second, the growth of new buds along the axis to form those new parts, the adult forms of which have already been described in some detail. The former division includes the consideration of the changes in form which the colony as a whole passes through in the growth from an egg to an adult like Fig. 1; the latter, the development of each of the different members of the community, or their growth from buds formed on an axis already well developed.

[1] NATURALIST, 1880, p. 617.

I. DEVELOPMENT OF THE EGG.

The new *Agalma* always begins its growth from an egg. I know of no case where any other method of origin than from an egg takes place among Siphonophores. Alexander Agassiz describes in *Agalmopsis cara* a reproduction by a bud from the stem, and says that this bud has a well-developed float before it separates from the stem or axis. In *Agalmopsis picta*, a species closely allied to *Agalmopsis cara*, no such budding of a new colony takes place. In the excellent volume already quoted, entitled "Seaside Studies in Natural History," it is suggested[1] that those organs which I have called "tasters," drop off and develop into new colonies. I consider this supposition improbable as far as any known genus of tubular jelly fishes is concerned. In the genus *Agalma*, as before stated, reproduction is always from the egg.

I was fortunate enough to find in the glass vessel in which the first *Agalma* captured by me was confined, that the water was filled with minute transparent spheres, no larger than the head of a pin. They floated about in the liquid, and were not limited to any definite depth, but when the contents of the glass became quiet, all rose to the surface, and thickly crowded together, covered it like so many small oil-globules. When they had collected in this way, I was able by means of a watch crystal to skim them off, and transfer all into a more convenient receptacle for study.

These little oil-globule-like spheres were originally cast into the water from the female sexual bells, and are eggs, from each one of which grows a new *Agalma*. The female bells are found in grape-like cluster just below the feeding polyps, and appear to take the form of individuals, which have apportioned to themselves the single function of reproduction of new *Agalmata*. They have no stomach nor mouths, but draw their nourishment from the cavity of the axis into which it has been poured by those individuals of the colony, which do all the eating for the *Agalma*. Each bell contains a single egg, and after that egg has been cast, the bell withers up, or is absorbed into the stem, or sometimes before the egg escapes, breaks loose from its connection with the axis, and drops into the water with the contained egg. The last process takes place by a rupture of the pedicle by which the female bell is hung upon the axis of the *Agalma*.

[1] The authors state that they have never seen these "closed Hydræ" drop off, but they suggest that it "seems natural to suppose that they do separate from the parent stock" to found new communities.—*Sea-Side Studies, p. 80.*

The eggs cast into the water are then impregnated by sperm from the male bells. Previously to this event the egg is of course incapable of development, and it is an interesting fact that the male bells of one colony cannot fertilize the eggs from the same. I need not remind the reader how widespread this law is in the plant world. Two sexes are joined in the same *Agalma* colony, but self-fertilization is not possible. The egg cannot be impregnated by the male element from the same *Agalma* as that from which it arises, but is cast into the water, and there fertilized by the males from another *Agalma*. Artificial impregnation of the egg often fails because this principle has not been recognized and followed. Although there are very many known examples, where an animal has the power of casting eggs capable of development before the adult form is reached, nowhere do we find this principle in nature better illustrated than in *Agalma*. Even before the *Agalma* has doffed features called embryonic, from the fact that they are limited to the young, and are not present in the adult, the jelly fish lays eggs, which, strangely enough develop into other *Agalmata*, and eventually into the true adult form, which their parent had not attained to when they were cast. The egg floating in the water after the escape from the female bell is transparent, and has a cell contents, but with no differentiation in any part except the existence near one pole of a more transparent space containing a dot. These structures are called the germinative vesicle, and the germinative dot respectively.

The first changes which I have observed in the egg after impregnation, or contact with the male element, is the formation in the germinative vesicle of a number of radiating lines, which give to it an indistinct likeness to a wheel with radial spokes and a central hub, which is represented by the contained dot. At the same time there separates from this region of the egg two small spherical bodies similar to those cells which in the eggs of some other animals have been given the name of direction cells. The radiated appearance in the germinative vesicle, is what is known as segmentation, and is very peculiar in *Agalma*.[1]

The next important change in the development of the egg after the segmentation above described has taken place, is the disap-

[1] Of the obscure method of segmentation among Physophoridæ much remains yet unknown. The account which I have given of the peculiar radial structure in the germinative vesicle may be of something else than segmentation. See P. E. Muller, Naturhistorisk Tidsskrift, 3 R. 7 B, 1871.

pearance of the germinative vesicle altogether, leaving the egg perfectly homogeneous, and covered with short vibratile hairs or cilia, by the motion of which it is driven through the water. Intermediate changes, too technical to speak of in this account, occur, but I have omitted to mention them. Now opens a long chapter of the developmental history, which includes stage after stage, each different from its predecessor, following one another in rapid succession, all looking, although sometimes indistinctly, to the formation of a new *Agalma.* Of these stages in growth there are three which are characteristic and so distinct, that I have deemed them worthy of special names. They are of great importance in a study of the systematic position of *Agalma,* and are as follows:

1. Primitive larva or primitive medusa (Lizzia stage).
2. Athorybia stage.
3. Young resembling closely the adult, but still retaining embryonic structures, *i. e.*, embryonic tentacles, covering scales, &c.

Between the primitive larva, the Athorybia stage and the adult *Agalma,* there is very little likeness. The third stage, however, has in most particulars a very close resemblance to the adult as figured in my sketch, Fig. 1, and differs from it only in size and in certain minor details. It is indeed very difficult to decide when the adult form of *Agalma* is really reached, for it begins to lay eggs when in an immature condition, as far as adult characters are concerned.

The first change in the egg, after the peculiar process called segmentation which I have already described, is the formation of a stage in which the germinative dot and vesicle disappear. A knowledge of this fact may be of use to one studying the process of development, for unless these structures in the egg of *Agalma* do disappear, the egg will not pass into following stages. Haeckel erroneously states that the germinative dot and vesicle does not disappear in genera closely allied and perhaps identical with *Agalma.*

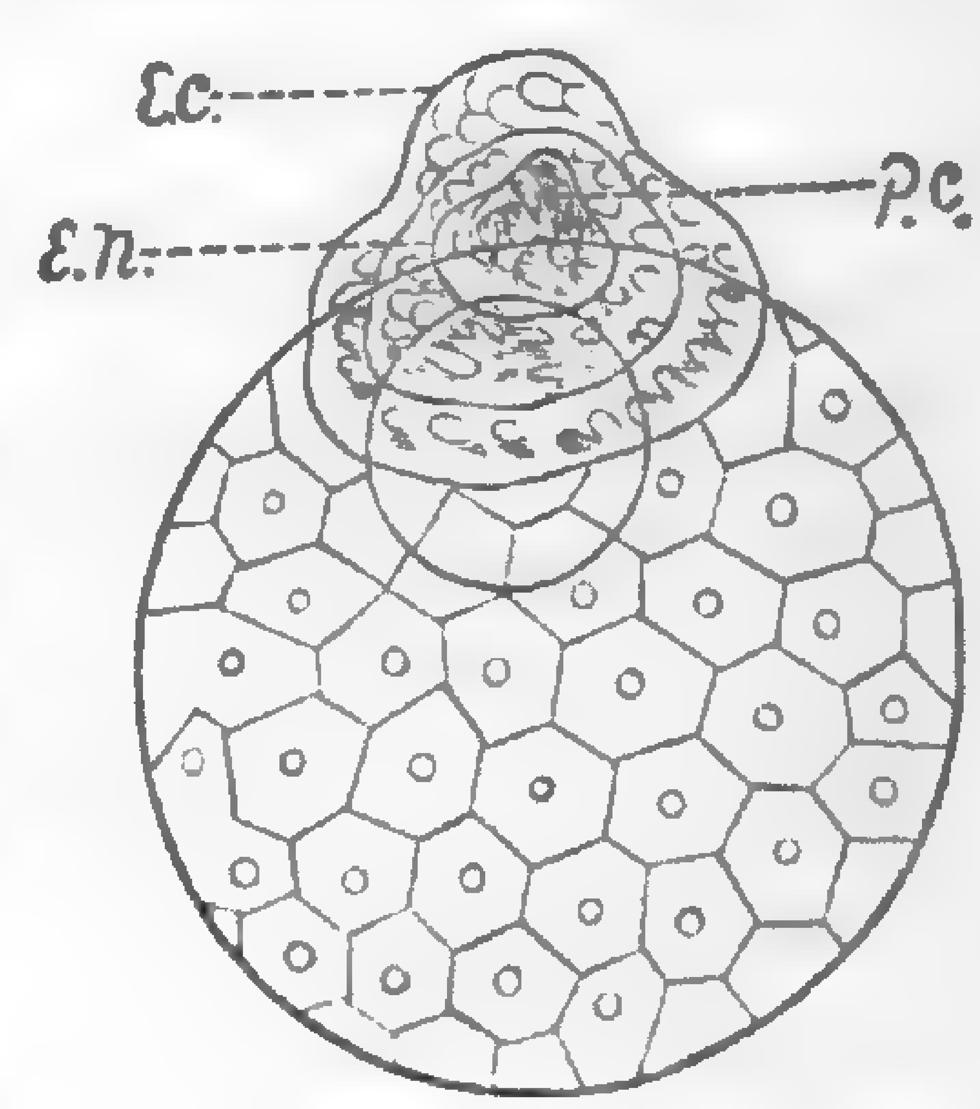

FIG. 7.—Egg of *Agalma* with apical elevation.

The next stage is the planula with the whole surface covered with cilia, which is followed by one in which is formed at one pole an elevation composed of two layers, which also becomes very thickly pigmented. The most superficial of these layers is formed before the more profound. The former is called ectoderm; the latter, endoderm, and between them is a third which eventually becomes very thick, forming the great mass of a helmet-like structure of gelatinous character, which gives the characteristic shape to the primitive larva. This enlarged layer corresponds with that which forms the mass of the bell of an ordinary free medusa.

All these layers are formed at one pole of the egg, and gradually, as their elevation above the surface of the ovum continues, their edges grow down towards the equator of the egg. The limit of this growth is the opposite pole at the other end of a diameter opposite that from which they originated. In subsequent growth the yolk sac itself, in the genus *Agalma*, is transformed into a feeding polyp of peculiar kind. According to Haeckel this transformation does not occur in genera closely allied to that which I have considered. The modified yolk-sac may be detected in later stages of the growth of an *Agalma* by a peculiar network of bright crimson pigment spots covering one side of the polypite into which it is changed.

A continued elevation of the layers, at the pole of the egg, has left below the deeper a small cavity. This cavity is bounded by endoderm on the upper side and by the undifferentiated contents of the egg-sac on the other. The middle layer, which I have said lies between ectoderm and endoderm, increases very rapidly, and the ectoderm keeps pace with this enlargement, yet in an inverse ratio becomes relatively thinner and thinner, until it is reduced to a simple epithelium layer, in which condition it is found in the adult of all the bells, and nectocalyces of the adult *Agalma*.

At the same time that the middle layer is thus enormously increasing in size, the endoderm, which lines the primitive cavity has pushed out into this growing layer and its cavity has elongated into a tube, which at one end opens into what remains of the primitive cavity, and at the other seems to end blindly in the gelatinous substance of the apical enlargement of the embryo. The gelatinous middle layer now thickens so much that it has formed a helmet-like body, the rim of which extends down along the sides of the larva in the form of a free ring separated on all sides except at the apex of the larva from the larva itself.

It may be well, before we go farther, to point out that in this larva, which is the so called primitive larva, we can recognize all the organs of the jelly fish, called Lizzia, one species of which, *L. octopunctata*, is found in the waters of our bays. The helmet-shaped organ of the larva of *Agalma* will be seen to represent the bell of the Lizzia, and the egg from which it has developed the proboscis. The central tube of the helmet of the young *Agalma* is the exact reproduction of the early condition of four tubes in the bell through which the nourishment of the Lizzia circulates, and which are called chymiferous vessels. Tentacles or structures corresponding with these thread-like organs, which arise from the margin of the bell of a Lizzia, do not in fact exist depending from the rim of the helmet-like cap of the primitive larva.

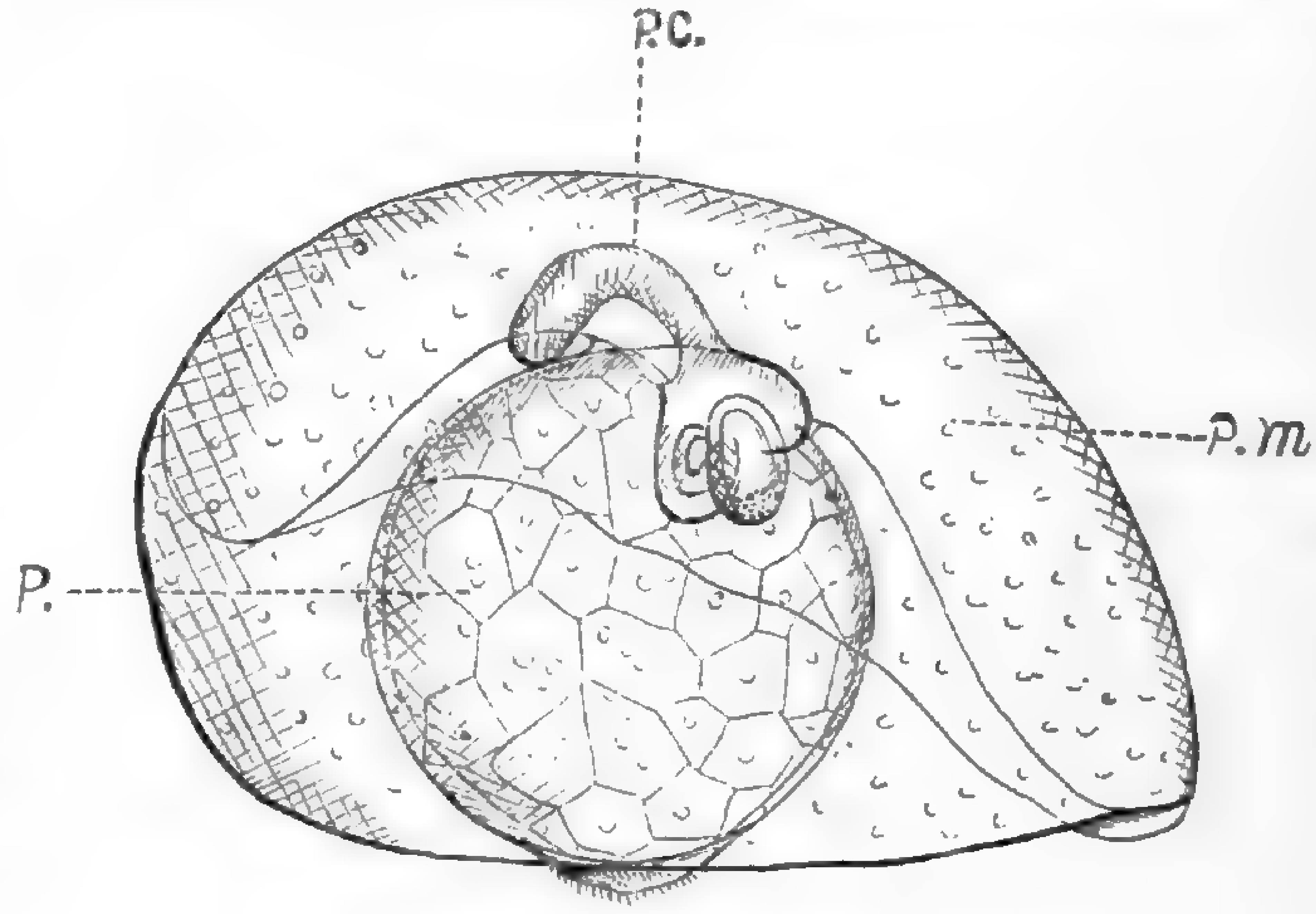

FIG. 8.—Primitive larva of *Agalma*.

The primitive larva or Lizzia stage of the young *Agalma* is well formed at the end of the fourth day after the eggs have left the female bells. Its change into the following or Athorybia stage is very rapid, and in outward appearance very radical. Before considering the details of these changes let me give names to the different parts of the primitive medusa, or Lizzia stage, in order to simplify references in the following pages.

The helmet-shaped bell, fitting over the egg from which it was formed, bears very many resemblances to a covering scale, and under that name it has generally been described. To avoid confusion, I suggest for it the name of primitive covering scale, the meaning of which designation is, I think, self-evident. The tube-like cavity in its center may be known as the primitive tube and the cavity in the eggs itself, from which this tube is differentiated, as the primitive cavity. That part of the larva which corresponds to the proboscis is designated the primitive proboscis.

The Lizzia stage of the young *Agalma* is followed by a second, which from its resemblance to a genus of Siphonophores, called Athorybia, I have called after Claus, the Athorybia larva, or Athorybia stage of *Agalma*. About the same time that the primitive medusa stage is reached, there appears as a bud from the primitive tube a small structure, which later develops into a float.

This body is not the end of the primitive tube enlarged, but is a true bud from it, and as such should be considered in all our studies of its homology.

2. ATHORYBIA STAGE OF THE YOUNG AGALMA.

As the primitive medusa grows older, the primitive covering scale is lost, either by absorption or by a rupture of the connection with the growing larva, and new buds take its place, forming a circlet of covering scales just under the float. These covering scales are different from those of an adult *Agalma*, and have their edges very finely serrated. They are in fact very similar in their structure to the covering scales of the genus Athorybia, and on that account the name of Athorybia stage, seems not inappropriate to apply to this condition of the growing *Agalma*.

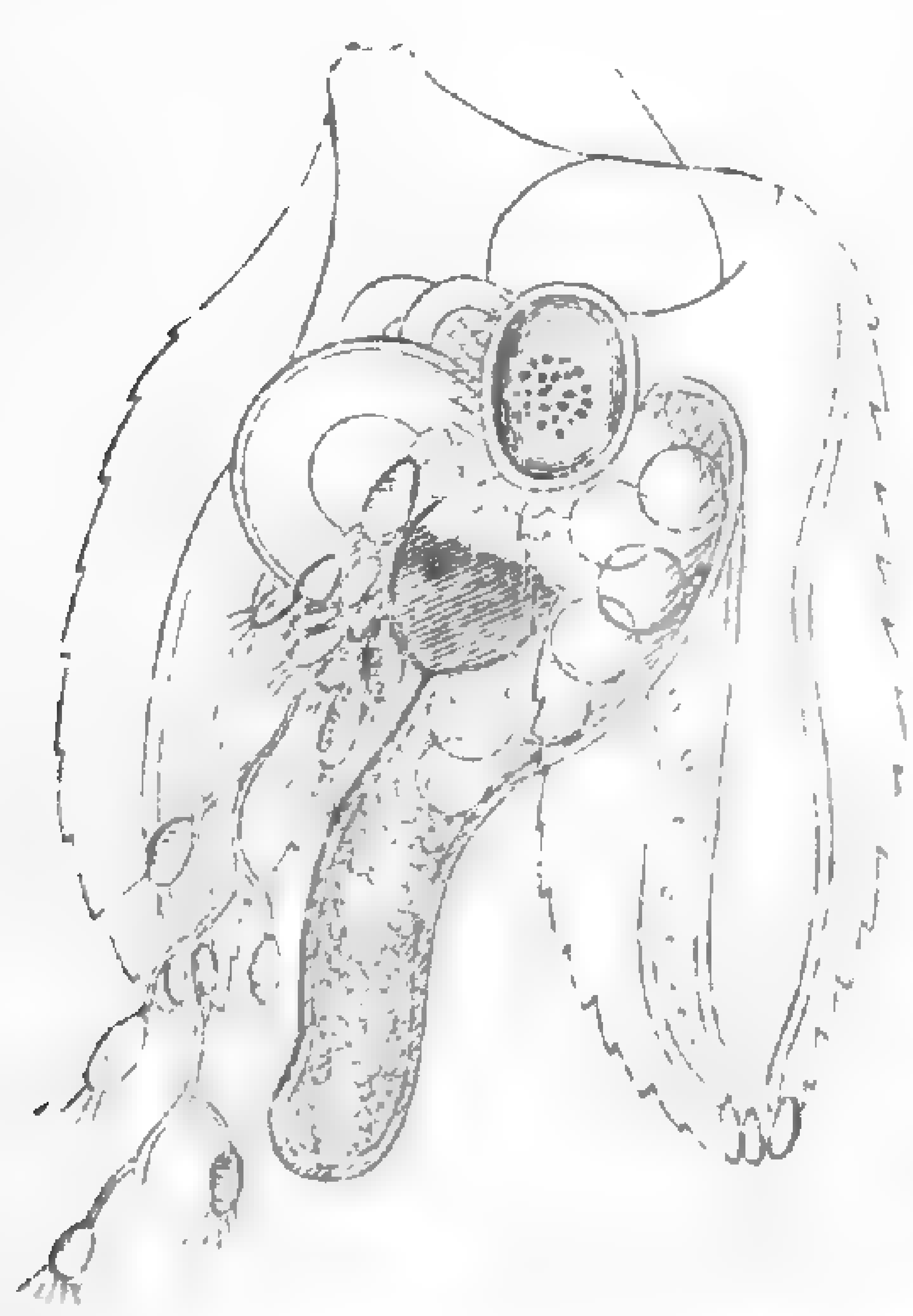

Fig. 9.—Athorybia larva of *Agalma*.

Another peculiarity of this stage is the character of the tentacles, and the knobs which hang as pendants from them. The tentacular knobs of the Athorybia stage never develop into an adult knob like Fig. 4. They are embryonic and are confined to the young larva, more especially to that stage known as the Athorybia larva. On account of their restriction to larval conditions it may be well to speak of them as the larval knobs. They are club-shaped, and from peculiar cells at the distal end there arise structures which resemble stiff hairs. (Fig. 9.)

3. LARVA WHICH RESEMBLES THE ADULT.

(PHYSOPHORA STAGE.)

The Athorybia larva has no swimming bells and no elongated axis or stem, but immediately after that stage is reached an axis begins to form at the same time that buds, producing swimming-bells, make an appearance. A circlet of covering scales of very different outline and destitute of serrated edges, replace those which characterize the Athorybia larva. A new tentacle, with tentacular pendants like the adult, also make an appearance, so that we have a stage in which both kind of pendants, embryonic and adult, are to be seen. I have called this stage of the young *Agalma* the Physophora stage, because at the very end of the stem its cavity is enlarged, and on that enlargement hangs a circle of covering scales not unlike what exist in the genus of Siphonophores, called Physophora. The larva is now in a condition structurally not very distant from the adult. In minor details there are, as has been already pointed out, certain differences, but from this stage on the growth into the adult is direct and without the formation of provisional organs of any kind.

A description of the development from the bud of each kind of characteristic structure found on the stem of the *Agalma,* would take me into details too special for this paper. It is sufficient for our argument as to the nature of the *Agalma*, to state that each and every structure along the stem originates as a simple bud, which can at first hardly be distinguished one from the other,

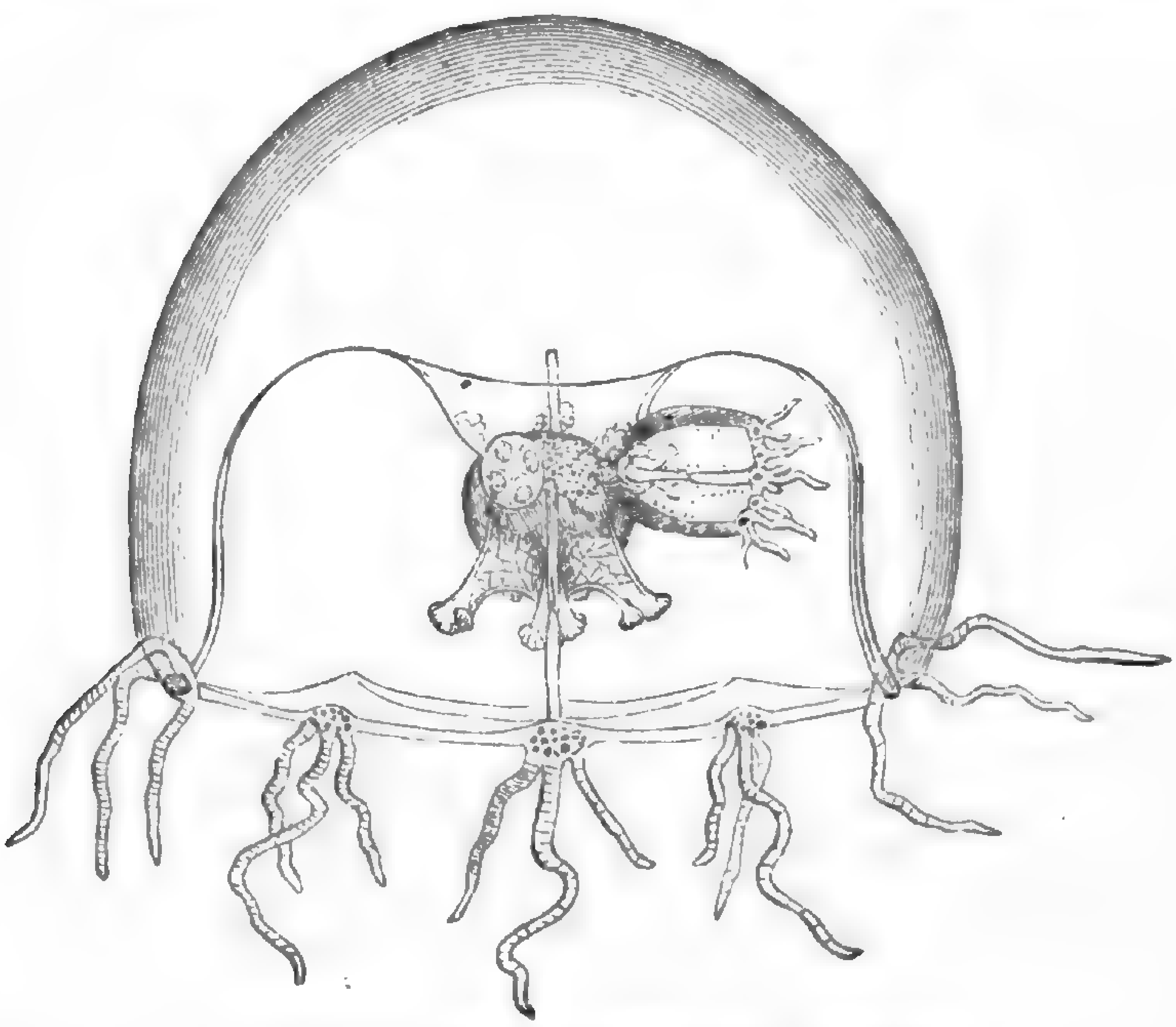

FIG. 10.—*Lizzia octopunctata* (young).

whether they form float, swimming-bell, feeding polyp or covering scale. In their earlier stages they are all alike. The details of the changes by which now a swimming-bell and now a float is formed are not necessary for my argument, and I will not consider them in this place.

I have already, in my former sketch of the anatomy of *Agalma*, made the comparison of the Siphonophore to a little medusa, called Lizzia, found in our waters. That comparison at which McCrady hinted long ago is supported by the embryology which I have just given.

In the primitive medusa, as has been shown, we find a jellyfish with parts identical with those of a Lizzia. All the organs are duplicated in one and the other. What are the changes of form which in subsequent growth so alter the external form as to produce in the one case a Lizzia, such as I figure (Fig. 10), and in the other an *Agalma?*

In the figure of *Lizzia octopunctata* Forbes *(grata* Alex. Agassiz), a species common in Massachusetts bay, several buds can be seen through the bell, forming on what is known as the proboscis. If these buds are closely examined, it will be found that they are young Lizziæ in different stages of growth, and if the proboscis of the largest of these buds be minutely studied, on it will be found buds of still a third generation, grandchildren of the original jelly fish. All these buds whether products of the first or second budding process, eventually break away from the place from which they first formed as buds, and swim away as jelly fishes, the form of which is not unlike the parent from which they sprung. Even before that separation takes place, the impatient young may be seen opening and shutting their bells, and swinging on their fragile stems trying to break themselves loose.

Suppose now that the proboscis of the Lizzia from which the buds formed was very much elongated into a tube. This tube then we liken to the axis of an *Agalma*, and if buds were formed along its whole length, as can be very easily imagined, the likeness would be even more striking. To be sure all the different buds in the *Agalma* are not of the same form or outline. Neither are they alike in the Lizzia. Some are very fully grown while others are in incipient stages of growth. This variety in shape could not then be an objection to the comparison which I have urged.

Each bud which forms along the stem of an *Agalma* is called by some naturalists an individual, from the fact that in early stages they resemble each other so closely, and when fully grown oftentimes certain of them bear such a close likeness to forms of Medusæ, which lead an independent life. I do not consider every bud an individual, but think that in some cases the position on the stem or other causes has so modified them that two or even more buds, as in the case of polypite, and covering scale together make one true individual. A zoöid, as defined by zoölogists, does not seem to be a fitting term to apply to these structures found along the axis of an *Agalma,* unless the term be given the broadest extension. In such a case the distinction between a zoöid and an individual does not seem very great. Through those jelly fishes called the Trachynemidæ, as Circe, there seems to be a close relationship between the hydroid Medusa, Lizzia, and the common Aurelia, Cyanea and other Discophoræ. As therefore I cannot but designate a Pelagia, also a Discophore, as an individual, I must look upon a Circe as the same, and since Lizzia and Circe are closely related, their free Medusæ are likewise morphological individuals. If this is true, and our theory of the likeness between *Agalma* and Lizzia not fanciful, is it proper to call the members of the former colony zoöids, or shall we regard them true individuals?

The solution of this problem as to the exact nature of the members of an *Agalma* colony is most difficult, and, as so many before me, I must leave this speculative part of my subject with the trite remark, that in this animal we have a condition of life where the difference between organ and individual is reduced to a minimum. It is without doubt true that much of the controversy which has been indulged in, as to the exact nature of the different components of the *Agalma*, may reduce itself to a quarrel about terms.

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THE RELATION OF APICULTURE TO SCIENCE.[1]

BY A. J. COOK.

I ONCE heard a well known professor and scientist, than whom there is no better student of American agriculture, remark, that the art of agriculture was founded almost wholly upon empiricism; and that all it had to thank science for, was that the latter explained what had already been determined by the empiric method. Whether this be true or not, the reverse is most certainly true of practical entomology. Economic entomology rests almost wholly upon science. So, too, apiculture, as practiced to-day, owes its very existence to science. Fear deters most people from bee-keeping, unless a desire to study bees, and to know more of the nature and habits of these marvels of nature, impels to that close association with bees, which practical apiculture demands.

For this reason, there is no class of men engaged in manual labor pursuits which possesses the intelligence and enthusiasm which characterize apiarists, or which practices so much that is really sci-

[1] Read before the Entomological Section of the A. A. A. of S.

entific. The successful apiarist of to-day must be able to inspect every part of his hives; must be constantly familiar with the precise condition of every colony of his bees; must be possessed of quick and accurate powers of observation. Thus we understand why science has gleaned so much from practical apiculture.

The nature of the several bees in each colony, as to sex, function and longevity, is now well known to every intelligent apiarist. The peculiar characteristics of queen, drones, and workers, and the peculiar duties of workers of different ages, are matters of daily observation.

The queen is seen to lay three or four eggs per minute, and the apiarist, by adding comb with empty cells, proves that she may lay as many as 4000 eggs per day. Aristotle was correct, then, in calling the queen the mother, and Virgil wrong in pronouncing her to be the king. Her hatred of rivals is easily shown by the certain combat, fatal to one of them, when two queens are placed together. This enmity induces swarming, as bees rarely suffer a plurality of queens in the same hive. In swarming the queen never leads, yet the special place of clustering is usually determined by the queen. Unless the queen accompanies the swarm, the latter will always return to the hive.

By clipping one wing of a virgin queen, so that flight will ever after be impossible, the bee-keeper quickly proves the correctness of the great Huber's discovery, that queens always mate on the wing. The same experiment proves the correctness of Dzierzon's more wonderful discovery, that drone bees are a result of agamic reproduction. No queen whose wing is clipped while yet a virgin, so far as I have observed, and I have tried the experiment many times, will ever lay eggs that will produce other than drone bees. It is also true that if a queen is forced to virginity for three or four weeks, she will always remain a virgin.

Upon the queen's return from her mating flight, we may observe the evidence of success, as she always if successful bears away a portion of the drone's reproductive organs, which remain attached to the queen for some hours.

It was a theory of the late Samuel Wagner, that the placing of unimpregnated eggs in the larger cells of the drone comb, and the impregnated ones, in the smaller worker cells, was simply automatic. The pressure from the smaller cell upon the queen's abdomen, forced the sperm cells from the spermatheca, as the eggs passed by. As there would be no such pressure from the larger drone cells, the spermatozoa would not be extruded from the spermatheca. Practical bee-keepers have shown this to be untrue.

Queens have been seen to lay eggs in the still larger queen cells, which eggs are always impregnated. The queen often lays in worker cells, where the walls are but just commenced, and where there is no compression; yet such eggs are always impregnated. That the bringing of the sperm cells into connection with the germ cells, or the withholding of them, as the eggs are to produce females or males, is a matter of volition with the queen, is sustained by the muscular character of the spermatheca. It is a curious fact, that young queens, when they first commence to lay, often put several drone eggs into worker cells, though after the first day or two, they generally deposit only impregnated eggs for the first season. It seems probable, that the muscles of the seminal sack of the queen do not act efficiently till somewhat in practice.

An anomalous physiological fact is illustrated in the flight of the queen when swarming takes place. Though she may not have used her wings since her marriage flight, possibly for two or more years, yet the muscles are by no means atrophied, as shown by her rapid flight, often for several miles, *en route* to her future home.

The reason why a few impregnated eggs develop into queens, while thousands of the same produce worker bees, appears to be wholly due to quality and quantity of food. They receive much more and much richer food. The enlarged cell is necessary to a full sized queen, but not to a queen. The exceptional position of queen cells is simply for convenience, as it is not important.

Direct observation, as also her removal from the hive, shows that the only function of the queen is to lay eggs.

I have known a queen to lay with no abatement of fertility for five years, though often in one or two years she ceases to be prolific, either from her own impotency, or from a depletion of the spermatheca, in which case only drone bees are produced. Usually the worker bees arrange to supercede the queen before she becomes an exclusive drone producer.

Common observation proves that the drones are males, that they are great eaters, and that they have no function in the economy of the hive, except the sexual function. As already explained, the drone loses a portion of his reproductive organs, in mating, which act is attended with immediate death.

Though doubt is sometimes expressed as to the origin of drones by parthenogenesis, there is no such doubt among intelligent apiarists. If the wing of the virgin queen is clipped, or the entrance to the hive so contracted that she cannot fly, or again, if she is reared when there are no drones, she will be, not sterile, but from her eggs will come only drones. Often these will be in the small cells, when the drones will be no larger than the workers. The eggs from fertile worker bees, and also from old queens, with depleted spermathecas, will likewise produce only drones. In appearance and structure these drones are every way normal. I have no doubt but that they are functionally perfect.

There is an interesting fact connected with the appearance and disappearance of drones, whose explanation seems to call for an intelligence above instinct. As the colonies become very populous in spring, the worker bees build drone comb, and rarely even tear down and replace worker with drone cells, and the queen lays the unimpregnated eggs in such cells, preparatory to rearing queens, and to swarming. If we remove a queen none but drone comb will be built. Now suppose a colony is strong and preparing to swarm, and suddenly, from lack of bloom, continuous rains or great drought, the secretion of nectar suddenly stops. Honey gathering of course ceases, brood rearing is discontinued, and, not infrequently, the bees kill all the drones, and even drag the larvæ and pupæ from the cells. As soon as the honey harvest is hopelessly cut short by the autumn frosts, the worker bees commence at once to bite and worry the drones, till the latter are driven forth to die. But if the colony be queenless, or if the queen has become superannuated, the drones will be permitted to remain in the hive all winter. The fate of the drones hangs on the prosperity of the colony. With rapid increase of bees and honey they are safe; adversity in these respects, unless caused by loss or impotency of the queen, betokens their speedy extinction.

Drones are tolerated in a strange colony, which is not generally true of either the queen or workers.

The longevity of drone bees, as we have seen, is largely dependent upon circumstances. There is good reason to believe that they may live through the entire season.

The worker bees are imperfectly developed females, which from receiving less and different food, while larvæ, are immature in their sexual development. A worker larva, less than three days from hatching, will, if given more and richer food, develop into a queen. If an apiarist allows a colony to go queenless for a long time, fertile workers are almost sure to appear, from whose eggs, however, none but drones are produced. Some apiarists suppose that such workers receive, perhaps by accident, a richer and more abundant pabulum. I have wondered if this might not verify Lamarck's idea of evolution. The bee desires eggs, and the deeply felt want induces the extra ovarian development.

The worker bees are shorter than the drones and queen, and less robust than are the drones. Their wings are small but strong, and move very rapidly in flight. When the bees are angry the rapidity is still more marked, and there is a corresponding increase of pitch to the hum.

The workers, as the name implies, do all the work of the hive, hence a reason for their better developed mandibles, with which they cut comb, remove cappings and dig pollen from the cells; their longer tongues and maxillæ, with which they extract nectar from deep tubular flowers, and the deep baskets on their posterior tibiæ and basal tarsi, which are wanting in the queen and drones, in which they carry pollen and propolis to their hives. As they protect the hives from intrusion, they need and possess a better developed sting than that of the queen, which is only used in dispatching rivals.

By the introduction of Italian bees, which differ greatly in color from the German or black bees, bee-keepers have learned that the old bees, for the most part gather the honey pollen and propolis while the young bees remain within the hive and secrete the wax, build the comb, feed the brood and cap the brood cells, though the old bees will do the work of the young ones if for any reason the natural equilibrium of the colony is destroyed.

That bees possess and use the sense of smell, is obvious to the apiarist. If he unite two colonies, they often engage in fierce combat, which only terminates when one of the parties is vanquished. By smoking, sprinkling with an essence, or otherwise giving to both the colonies the same scent previous to the union, perfect peace and harmony is secured. The same fact leads to somewhat similar precautionary measures in introducing queens.

In going to any place, bees seem to be guided by direction rather than sight. Thus if we move a hive, but for one or two feet, the bees will, for days, descend to the old position, and then turn abruptly to the hive. I have been led to notice a strange exception to this; by placing honey on a porch of one of two houses that are exactly alike, but about five rods apart, many bees were misled and swarmed about the porch on which there was no honey. The experiment was several times repeated.

Experience shows that bees will winter quite as well with pure honey or sugar syrup for food, as though they had pollen with it. They may be kept healthy at least for a time, in confinement, in summer, on a pure hydro-carbonaceous diet, and will secrete wax and make comb, with the usual activity. But pollen is a *sine qua non* to brood rearing. Probably it is also necessary for the old bees, at times of great activity. Bees also need water. Unless very active, this want seems to be met by the water of the honey; but in shipping bees they are now generally fed with candy or crystalized sugar, and unless water is added, they perish in a few days.

Nectar, as gathered from the flowers, contains much more water than does the honey. The bees leave the nectar, which is often nearly as thin as water, some time before capping, until the necessary evaporation has transpired. Bee-keepers call this the curing process. Some nectar is so thick that it is capped very soon, though frequently it remains for days, and rarely is it of such a nature that it does not thicken, and the bees refuse to cap it at all. Such nectar, usually from bark lice, etc., is unwholesome, and unfit food, even for the bees. If thin nectar is extracted, bee-keepers evaporate the moisture from it by artificial heat, as it does not preserve its quality unless rid of the superfluous water.

One of the most terrible disasters that can befall the apiarist is to become the victim of foul-brood. In this terrible disease a fungus attacks the brood, which causes it to become putrid and disgusting. It is very contagious. The disease is common in Europe, and has brought ruin and discouragement to apiarists in several of our own States. Spraying with salicylic acid has been found an efficient cure.

The enemies of bees is certainly a matter of interest to all scientists, and especially to zoölogists. Among mammals, shrews and mice are often quite destructive to bees. The king bird, *Tyrannus carolinensis*, captures worker bees, although it is partial to drones. Toads and frogs seem to lap up bees with no inconsiderable relish, and often work quite successfully to deplete the hives.

Bees have many and formidable foes among insects. In the order Hymenoptera, a species of Xylocopa, probably *X. micans*, has been observed to kill bees in North Carolina. The cow killer, *Mutilla coccinea*, destroys bees in the States from central Illinois to Texas. It has been reported several times that ants are at times a serious foe to the honey bee. It is stated that they not only worry the bees by invading the hive, but that they sometimes kill both the queen and workers.

The only lepidopterous insect which annoys American apiarists is the bee-moth, *Galleria cereana*. And even this is no dread to the intelligent apiarist. It is found that strong colonies of bees, and no other pay, and especially if Italians, will always defend themselves against this enemy. It is only weak or queenless colonies that succumb to this foe.

Among Diptera, *Bombylius mexicanus*, is reported to enter the hives, in Texas, without resistance and lays its eggs, where the prospective larvæ will be nourished and cared for, without labor on the part of the mother fly. The family Asilidæ affords the most serious dipterous pests to the apiarist. Of these there are at least three species of Asilus, two of Mallophora, two of Promachus, two of Laphria, and two of Erax, that catch and kill bees. These predacious flies work the most serious mischief South, but are not exempt from blame even as far North as Ontario. A parasitic fly of the family Tachinidæ is destructive to bees in several of the States.

In importing bees, the bee louse, *Braula coeca*, has been introduced from Europe; but so far it promises to do little harm in our country.

Amongst Heteroptera, *Phymata erosa* is a dreaded foe of the honey bee. From its close mimicry of the flowers of many composite plants, in which it is wont to hide, it finds it easy to grasp the bees with its unique anterior legs, when it soon sucks out their life juices. *Mantis corolina* kills bees from Central Illinois to the Gulf.

Many of the Libellulidæ, chief among which is *Anax junius*, are so fierce in their onslaught on bees, that they have been termed bee-hawks. These marauders depredate in all sections of our country.

I need not speak, at this time, of the value of bees in fertilizing flowers, as that has been ably discussed by our botanical friends. That bees ever injure buckwheat or other plants, by seeking nectar from their bloom, as is sometimes claimed, is known to be erroneous by all present. That they are equally harmless to grapes and other soft-skinned fruits is not so generally granted. Personally, I have never seen a case, though I have several times gone quite a distance to see them at the request of positive individuals. In each case, the bees were found never to attack sound fruit, but only to sip from such as had burst, or been torn by other insects or by birds. While I am not positive that bees are never guilty of such wrong-doing, I do feel certain that such actions if ever true, is quite exceptional. I have lived in California in the midst of apiaries and vineyards, and I have yet to see the first case of such depravity among bees.

The two great improvements in apiculture since the Langstroth hive, and scientific knowledge gave the apiarist such perfect control over his bees, are the extractor and comb foundation, both of which are recent inventions. In both cases the thought came from Germans, but perfection in carrying it out is due to Yankee genius.

The honey extractor works on the principle of centrifugal force, and by its use honey may be thrown from the combs before it is capped over, or afterward if the cappings be first removed with a knife. By this practice the comb is used over and over again, and as a result, at least twice as much honey can be secured. Experiment proves that it takes at least twenty pounds of honey to secure one of comb, besides the time of secretion is lost, as bees are usually quiet when employed in secreting the wax-scales.

Extracting is often very necessary to furnish room for the queen, so that she may lay eggs. In times of great honey secretion, the workers so fill the cells with honey that the queen finds no place for her eggs, so brood-rearing ceases, and as the workers live only for a few weeks in the active season, depletion of the hive is rapid and sometimes is carried to a fatal extent.

When bees cease gathering, from lack of nectar secretion the queen stops laying, and all brood-rearing ceases. Nothing is found to pay the apiarist so well as to feed sparingly, whenever there is a cessation from gathering honey, and so keep his colonies strong. The extracted honey furnishes a cheap and excellent food for this purpose.

Comb foundation is made from pure bees-wax and is a perfect copy of honey comb, as just commenced by the bees, except that it is much thicker. When given to the bees, they at once accept it, thin it to the usual thickness of natural comb, and use the parings to complete the cells. This saves the time and work of wax secretion and comb building, and secures straight combs, and exclusive worker cells.

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GLACIAL PHENOMENA IN THE YELLOWSTONE PARK.[1]

BY WM. H. HOLMES.

IN common with very many of the more elevated districts of the Rocky mountains, the Park district presents a variety of glacial phenomena. In exploring the deep valleys of the higher ranges, the geologist is never surprised at encountering on all hands partially rounded masses of transparent rock. These are pretty sure to be found on most of the old flood plains of the streams and often high up the sides of the valleys. They are frequently the only remaining records of ancient glaciers which have filled the valleys at different stages of their erosion. The glaciation of rocks *in situ*, in the narrow gorges, also bears testimony to the former existence of glaciers. Loose boulders are doubtless, in many cases, carried from their original beds by the force torrents, and not infrequently reach places very far distant from their original station by a gradual creeping or sliding movement —the result of undermining or yielding of the soil beneath. It is, therefore, far from safe to conclude that wherever erratic rocks are found, glaciers have formerly existed, especially in cases where these rocks may have had their origin in surrounding highlands, or even quite distant mountains of very considerable elevation.

In a region like this, however, there is every reason to suppose that glaciers once existed on a very extensive scale. The park, with the great continental water-shed that surrounds it, forms one of the grandest masses of highland in the United States.

In early quaternary times, as now—if there have been no important changes of level in the meantime—the general level of the park district exceeded eight thousand feet, and the broad areas

[1] Extracted from the unpublished Report of the U. S. Geol. Survey of the Territories. Exploration of 1878.

of mountainous country on the west, north and east, represent a former general elevation of twelve thousand feet or more.

Glaciers exist now in the neighboring Wind River and Teton mountains at elevations much below twelve thousand feet, and in the midst of glacial times descended in immense sheets to four thousand and five thousand feet. It would, therefore, be a matter of surprise if traces of glaciers were not found here, not only in the high valleys, but upon the surfaces of the broad plateaus of the park. There is, however, a singular absence of well defined glacial moraines. The tens of thousands of granite boulders that occur on both sides of the Yellowstone valley, from Cinnabar mountain to the north base of Amethyst mountain, generally lie upon the smooth surface of the flood planes of the river, or upon low ridges of alluvial drift. The significance of this fact may be that the transporting glaciers existed in the earlier stages of the erosion of the valley, and that the morainal ridges have been destroyed by the river as it oscillated from side to side in the succeeding stages of its descent from the plateau level to its present bed. These great boulders would, in such a case, be the more durable masses of the moraines stranded on the various flood planes for want of water power to transport them.

When we come to search for the source of the granite, we are led to observe an interesting fact. The only bodies of granite rock within the limits of this valley are found either on the north side or on the bottom at no considerable elevation above the river. But the erratic masses occur to a great extent on the south side of the valley and at all elevations. In the vicinity of Mt. Evarts they reach the upper surface of the plateau more than two thousand feet above the river bed. It is evident that these masses of granite were transported to their present resting places either before the valley existed or that the ice streams were so deep as to fill the valley to the brim and thus carry and strand them. Still it is a question whether in the latter case these boulders would ever reach their positions on the south side—supposing the glaciers to follow the course of the valley—as they would have to accomplish the feat of crossing the whole width of the glacier as a boat would cross a ferry. This could really only occur in case there should be such an increase in the masses of ice descending from the highlands to the north, as to completely fill the valley, sweep across its course and overspread the broad table-land to the south. This table-land I have named the Park plateau; it is wholly volcanic, and is separated from the base of the granite highlands on the north, by the valley of the Yellowstone proper, and by the East fork, its geologic as well as topographic continuation. It extends, with but few interruptions, one hundred miles to the south. We are here led to inquire whether or not there are evidences of former glaciers on this plateau. Such evidences do exist, but they are certainly not such as we might expect. Instead of well-defined moraines, an area dotted by erratic boulders and broad expanses of polished surfaces as in the Wind River and Teton mountains, we find only a few rocks other than those that may have been derived from the plateau itself. It should be remarked, however, in this connection, that the soft rhyolites which form the greater part of the plateau, would not retain glacial markings for any considerable length of time.

An occasional small block of granite indeed is found, and sometimes at unexpected levels, as on the slopes of the Washburn mountains many hundreds of feet above the general level of the plateau. A very few have been observed beyond Mt. Washburn, on the south side. The most remarkable example of these is a boulder resting upon the brink of the grand cañon, about a mile and a half below the great falls and nearly eighteen miles from the northern border of the plateau.

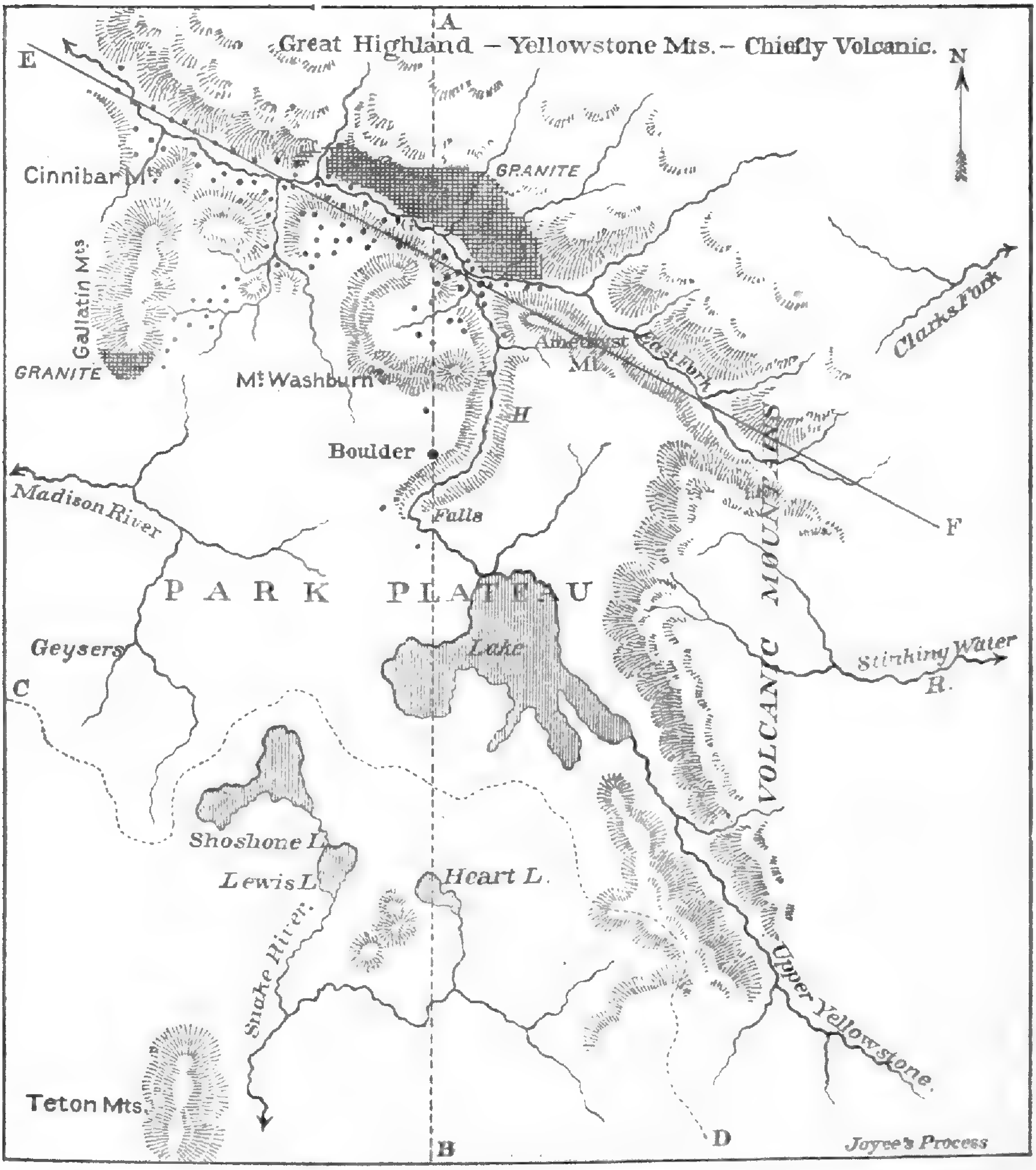
On a stormy day in December I undertook to meander the grand cañon from the falls to the base of Mt. Washburn, and during a storm of rain and sleet took shelter under the overhanging edge of a great rock in the dense timber. Considerably to my surprise I discovered it to be a very compact coarsely crystalline feldspathic granite. In shape it is somewhat rectangular, the edges for the most part sharp and unworn, the result of spawling by the heat of forest fires. In cubical dimensions it will probably exceed two thousand feet. It is within a stone's throw of the brink of the cañon and rests upon a sheet or a series of sheets of rhyolite, not less than one thousand feet in thickness, as may easily be determined by an examination of the section exposed in the cañon walls below.

In seeking the possible source of this rock we naturally turn to the south, towards the sources of the Yellowstone. The plateau along the river's course and around the lake is totally volcanic.

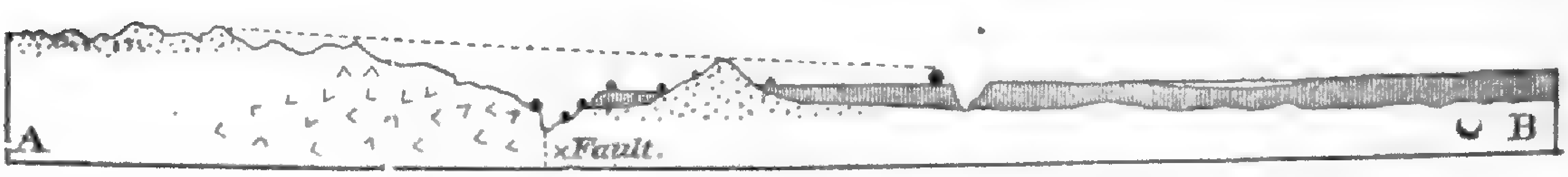
The great ranges to the east and south of the lake are not known to contain a single exposure of crystalline rock. That there are no such formations in the whole drainage of the Upper Yellowstone is established by the fact of the almost total absence of granite pebbles on the shores of the lake or in the bed of the river. The home of this wanderer must be sought elsewhere. To the north, beyond the valley of the third cañon and the East fork, lies the granite highland previously mentioned. To the north-west, beyond the valley of Gardiner river, at the southern end of the Gallatin mountains, is another exposure of granite at an elevation sufficient to have given origin to it. The distance in either case is upwards of twenty miles. From the great falls the river descends in a northerly direction until it strikes the base of the granite highland; here it unites with the East fork and turns to the west along the south base of that highland, following the line of the great displacement until it passes the granite gateway of the second cañon (see accompanying map). To reach its present position from the northern locality, the boulder must cross the course of the great valley of the East fork and the third cañon and ascend the river, as it now exists, a distance of twenty miles, avoiding on its way, by a circuitous route, the intervening Washburn range and the opposing mass of Amethyst mountain. If from the Gallatin mountains, it must first have crossed the valley of the upper Gardiner river and afterwards a considerable spur of the Washburn mountains—a journey of twenty miles south-east. Notwithstanding the fact that this pathway would, with anything like the present topography, seem to present fewer obstacles to the advance of a glacier than that from the north, I cannot regard it as at all probable that this was its course. The mass of the Gallatin mountains is not great. Glaciers originating in its short abrupt valleys would have no great longitudinal extent, and would probably advance no farther than the deepest part of the valley that lies along their immediate base.

The great ranges to the north are of sufficient extent to give birth to ice rivers of the grandest proportions. The present distribution of the erratic fragments of granite tends to strengthen the impression that they had their origin in the north. If this be admitted, it becomes at once clear that the erosion of the grand cañon has been accomplished since the close of the glacial period, or at least that a second erosion has taken place if a cañon did exist prior to the glacial epoch.

That a very profound erosion had taken place along the course of the cañon at a very early date is proved by the fact that during the rhyolitic period as well as the basaltic and andesitic, there



A–B, Section line. C–D, Ocean divide. E–F, Line of Great Fault. G, Third cañon. H, Grand cañon. The black dots indicate the position of granite boulders.



Glacial Phenomena of the Yellowstone Park.

were cañons almost as deep as the present one, into which the coulées cascaded. At one spot near the northern base of Mt. Washburn the section of a fossil river is exposed, more than half way down the cañon wall, the bed of which has been cast in andesitic lava, and the volume of whose water discharge is recorded in pumice stone.

These events probably belong, however, to miocene and pliocene times, and the topography of this region in those periods—the course of the rivers and the configuration of the country must for the most part remain unknown.

Topographic changes of quarternary times are, however, much more easily traced. The mass of glacial ice necessary to carry the great boulder described above to its present resting place would change the whole drainage of the park. The waters of the Upper Yellowstone and of the numerous tributaries of the lake would be forced across the low continental divide to the south and become tributary to Snake river and the Pacific, or otherwise to some of the western branches of the Missouri.

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A COLLECTOR'S NOTES ON THE BREEDING OF A FEW WESTERN BIRDS.

BY E. HOLTERHOFF, JR.

THE bird fauna of the country lying east of the Mississippi river, has been for years exhaustively studied and written about by the resident naturalists scattered over its entire surface; but the great expanse of territory lying west of that river has been comparatively little studied, and offers for the naturalist the greatest attractions. Especially is this the case in those territories, where, until the past few years, the military posts of the Government, and a few trading posts, constituted the sole settlements of the white man. Now, however, the advent of a resolute mining population has opened out much new country which will steadily continue to develop, and as population pours in, there will come some eager and able to investigate and make known its treasures of natural history.

It was with great satisfaction that I found myself in Southern California, in the spring of the present year, and at the commencement of the breeding season of its birds. And although I was called away by the first of April, and unable to study any but the earliest in breeding, yet a month later I was able to continue my studies and collections in the vicinity of Tucson, A. T., and in a still better field. And although not in the field as much as I could have desired, the results of my collections amply repaid me, and intimated how much more could be developed by continuous and extended search.

The hawks are very numerous in the vicinity of Los Angeles, Cal., and are represented by many species, the most common of which is the western red-tail hawk *(Buteo montanus)*. This large and beautiful hawk is very little different from its eastern congener, the *B. borealis*, being slightly larger and with some differences in markings. Its nests and eggs are scarcely distinguishable from those of the eastern species: the nest in situation, however, is more accessible and less concealed, owing to the scant and low growth of timber. This consists of sycamore, cottonwood, and oak trees of several varieties, and does not offer the protection of our eastern and northern forests. Another western variety of an eastern species, the western red-shouldered hawk *(Buteo elegans)*, is quite common, and several nests were observed, one in a willow tree not twenty feet from the ground, was quite thickly lined with pappus from the willow, which was likewise scattered about the nest generally. The eggs, three in number, were similar to those of the Eastern species, being of a dusky white ground color, marked with large red blotches. The brown hawk *(Buteo insignatus)*, is not rare, although not seen so often as either of the former, owing to its frequenting quiet secluded places. A pair of these birds took possession of an old last year's nest which I had examined once and found old and deserted, and, after slightly repairing the inside, and lining it with green mistletoe, proceeded to lay their eggs. Riding by the nest shortly after, I observed the bird sitting on it and secured both bird and eggs; the latter, three in number, of a faint greenish white tinge, and marked with a few large, dark red blotches around the larger end. Out of the many other varieties of hawks, some of which I could not determine, I did not succeed in finding any breeding, excepting the little sparrow hawk *(Tinnunculus sparverius)*, which is everywhere abundant, and whose eggs are familiar all over the country.

Among the owls, the great horned owl *(Bubo virginianus* var. *pacificus)*, is quite common and I found several nests rather late, and all with young birds in. The barn owl *(Strix pratincola)*, together with the long-eared owl *(Otus wilsonianus)*, I found in great numbers on the northern slopes of the foot hills, where in the dark shades of the thick growth of live oak, they found an abode well suited to them. The long-eared owl nested in great numbers in the oak trees, building a clumsy nest of coarse sticks and twigs lined with grasses, and laid from four to six dirty white eggs. The barn owl, while it remained in these thickets during the day, resorted more commonly to the bottom lands to breed, where in the hollow trunks and branches of the sycamores, it found its favorite resting places. Its eggs, also of a dirty white color, are not much larger than those of the long-eared owl, although the bird is considerably larger. The little burrowing owl *(Athene cunicularia)* is very abundant, inhabiting the deserted holes of the California ground squirrel, with which, as with the prairie dog, it seems to live in harmony. They had not yet commenced breeding when I left the vicinity of Los Angeles, or at least I found no eggs in the several burrows which I dug up. The mottled owl *(Scops asio)* breeds here, as a friend of mine found a set of four eggs, and captured the bird on the nest, but the bird keeps close in the hollow trees and can scarcely be scared from its retreat or nest, and thus escapes observation. Later, in Arizona, I observed several times a very small owl which I was unable to identify or procure a specimen of.

One of the earliest birds to nest in the vicinity of Los Angeles, was the white-rumped Shrike *(Collyrio excubitoroides)*. It is quite abundant, and owing to the brightness of its plumage, and the absence of many of the migratory birds which had not yet returned from the South, is very noticeable. I found quite a number of nests of this bird, all placed in low trees or bushes, and compactly built of small sticks and grasses, and lined thickly with the pappus from the Baccharis, a species of Compositæ. The eggs are very similar to those of other shrikes and are well known. Another early breeder is the California jay *(Cyanocitta californica)*. This bird is also numerous and with all the traits of the blue jay, is not near as handsome a bird. It builds its nest in a thick tree or bush, and while it resembles that of the blue jay, it never has mud in its construction. The eggs, varying in number from four to five, are very handsome, being of a rich emerald green color, and marked with numerous dark brown spots, thicker around the larger end. The California sickle-bill *(Harporhynchus redivivus)*, a thrush whose liquid melody of song may favorably compare with that of the mocking-bird, is a resident by no means rare in Southern California. It is, however, very shy and plunges abruptly into the nearest bushes on being approached or disturbed. It nests, after the fashion of all its family, in low trees or bushes, near the ground, and preferably in a thicket or secluded place. The only nest with eggs that I found was at Cotton, Cal., a short time after leaving Los Angeles. It was situated in a low elder tree, and was composed of coarse twigs and grasses, and lined with fine rootlets; resembling the nests of others of the Harporhynchus family, it was not so large as any of them. The three eggs, which constituted the complement, were well incubated. They were of a light pea-green color, marked quite thickly at the larger end with dark brown spots of a considerable size, and were rather elongated. Some weeks later, on the Colorado desert, at a station called Flowing Wells, I found a nest and two eggs of the LeConte's thrush *(Harporhynchus lecontei)*, a variety of the *H. redivivus*, according to Dr. Coues. It is a smaller and lighter colored bird than *H. redivivus*, and its nest and eggs are considerably different. The nest was placed in a palo verde tree and was a very bulky affair, measuring externally nine inches in depth and six in width; the hollow of the nest was fully three inches in depth. It was so awkwardly situated that much of the base of the nest had evidently been filled in to firmly support the structure. The two eggs were somewhat smaller than those of *H. redivivus*, lighter in color and marked all over with finer reddish spots, thicker at the larger end.

Campylorhynchus brunneicapillus is the long name given by scientists to a very odd little creeper wren which is peculiar to the south-western States and Territories. The cactus wren, so called from its habit of nesting in the cactus whenever available, is stationary in its habitat, keeping together in little flocks during the winter and separating early in the spring into pairs. They are very early breeders, numerous dates in February being given for the finding of nests and eggs. It was the tenth of April, however, before I succeeded in finding a nest with eggs, but shortly after I found nests containing large young ones. Their nests are worthy of notice, for they have no resemblance to the nests of any other birds in our fauna. They are shaped somewhat like a retort, and are laid on the branches or between the forks of a cactus. The body of the nest is rounded, often as large as a man's head, and composed entirely of grasses well interwoven and lined thickly with feathers. The entrance is by a long funnel-shaped passage on one side and at the top of the nest, and varying in length from six to ten inches. The lining of feathers is very thick and is comprised of feathers of many birds. Dr. Heerman, an old time ornithologist, has said that he would often tear open the nest of a cactus wren to ascertain what birds were in the vicinity. The number of eggs in a full complement is almost invariably five; occasional nests with three or four well-incubated eggs constituting the only exceptions. The eggs are of a pale salmon color, marked so thickly and evenly with darker salmon color as to give a very rich cast to the whole egg. While the bird commonly seeks the cactus to build its nest in, sometimes when this is scarce, it will build in a mesquite or other tree, and in this case almost always at a considerable height—ten to twenty feet. I am told that this bird raises a brood as late as August, and if it does, as I have no reason to doubt, it then breeds continuously during a period of six months. In that time one pair could raise five or six broods, but it is not likely that they make a new nest as soon as one brood is fully fledged.

A very common bird from the mountains to the coast, in California, is the brown towhee *(Pipilo fuscus)*. These plainly colored finches, although pre-eminently ground birds, nest in low bushes or scrub trees, contrary to the habits of the family. A nest, found shortly before leaving Los Angeles, was placed between the forks of a prickly pear cactus, and contained four eggs of a light blue color, marked with lines and dots around the larger end, resembling the eggs of some blackbirds. The nest was composed of grasses and fibers from the bark of the cactus, and lined with horsehair. There are two other species of the same genus and somewhat resembling this bird, which I afterwards found breeding in Arizona, the Abert's finch *(Pipilo aberti)* and the canon finch *(Pipilo mesoleucus)*. They also are tree or bush builders, and there is a similarity between the nests and eggs of all three. The Abert's finch built a somewhat larger and not as neat a nest as the others, composed entirely of grasses and lined with a few horsehairs. The eggs, larger than either of the others, were of a light blue color, marked with numerous black lines and spots in a ring around the larger end, and also with a number of bright red spots. The canon finch, nesting in the same situations, built a smaller and neater nest, composed of fibers from the dead cactus and a few fine grasses, and lined with the soft fibers. The eggs, three in number, like those of the Abert's finch, were of a light blue color and marked more universally and thickly with dark spots, thicker at the larger end.

The little house finch *(Carpodacus frontalis)* is everywhere abundant throughout Southern California and Arizona. I found its nests in all sorts of places and at all times. The eggs are very similar to those of our Eastern purple finch. The Western lark *(Sturnella neglecta)*, although everywhere abundant, escaped my notice in nesting until just as I was leaving California, when I found a nest and six nearly incubated eggs. There is no perceptible difference between the eggs and those of *S. magna.* The black flycatcher (*Sayornis nigricans*), a bird much resembling our pewee in its habits and mode of nesting, is not rare in California. They seem to be in pairs all the year round, and may raise a very early brood. The only nest I found was at Cabazon, Cal., and was plastered to the side of a house after the fashion of the barn swallow. It was composed of mud and lined with grasses, and contained four pure white eggs of delicate texture. At this same place, in some willow trees growing alongside a little stream, I found several nests of the Arkansas finch *(Chrysomitris psaltria)*, all with young birds except one, which contained four bluish-white eggs. The nest and eggs are very similar to our *C. tristis.*

After leaving Los Angeles, I proceeded by stages along the route of the Southern Pacific railroad, and with a short time to spare at different stations, found some nice things before reaching Tucson, A. T. At Colton, Cal., I first found the nest of that diminutive little bird, the least bush titmouse *(Psaltriparus minimus)*. An inhabitant of the Pacific coast country, it does not penetrate east of the mountains, but west of them is abundant the whole length of the coast. A small and plainly colored little bird, its habits confine it to the bushes, and it is not easily seen or distinguished. The first nest I found was suspended from the branches of a greasewood bush, and I at once recognized it, but thought it deserted, it looked so old. Tearing it open, however, I found it contained six small pure white eggs, partly incubated. Regretting my haste in spoiling the nest, I pursued my hunt, and was shortly rewarded by finding another nest suspended from the branches of an elder bush. I frightened the bird from the nest and succeeded in shooting it for positive identification. The beautiful little structure was shaped like a purse, and the contracted rim was worn around two or three little shoots of the limb, the nest hanging free. It was about six inches in length and was composed of mosses, shreds of vegetable fiber, inner strips of bark and lichens, all woven into a thick, strong felt, and the bottom on which the eggs lay was softened with willow down and feathers. The entrance to this remarkable structure was a small hole, not an inch in diameter, placed at the very top, and concealed by some leaves of the bush skillfully woven over it. The eggs, six in number in each nest, were unlike those of the rest of the family in being pure spotless white, without gloss. They were very delicate and not over a-half an inch in length. Another minute little bird, but of another family, is the black-headed gnat-catcher *(Polioptila melanura).* I first saw this gnat-catcher, to recognize it, at Indio, on the Colorado desert. There were a great many gnat-catchers around Los Angeles, but I did not notice them closely or shoot any, taking them all to be the blue-gray species. At Indio, however, in the clumps of mesquite trees, which first appear here, I saw numbers of these little birds and then recognized them as the black-headed species. There is a species of mistletoe which grows thickly in nearly every mesquite tree, and in it, after close search and watching, a pair of the birds. I found their nest woven to the branches in the heart of the parasitic plant. It was a delicate little structure, composed of various vegetable fibers, a down from some plant and fine strips of bark, compactly matted together and lined with the same downy material. The nests were not as handsome as those of the blue-gray gnat-catcher, but were very neat and elegant. The first nest found contained three young birds and one egg, but further search discovered another nest with four eggs in, slightly incubated. The eggs, about the size of those of the blue-gray species, were of a lighter color and more thickly marked with black and reddish spots. Later, in Arizona, I noticed the remaining species of gnat-catcher peculiar to our fauna, the Arizona or lead-colored gnat-catcher *(Polioptila plumbea).* It was too late at the time to find either eggs or young ones in the nest, as all that I saw were in little families—the parents and young brood.

At Indio I likewise first noticed a bird which became more common and familiar in Arizona, viz., the black-crested fly-catcher

(Phænopepla nitens). All along the line of railroad through the Colorado desert, where the mesquite grows at all—and this is at intervals only—I saw little flocks of these birds sitting on the tops of the trees, and ever and anon darting through the air in pursuit of insects. During my hunt for the gnat-catcher's nest I started one of these birds from a thick clump of mistletoe, and on close examination discovered its nest in it. Climbing the thorny mesquite with many a scratch, I at length succeeded in getting a footing where I could look in the mistletoe and examine the nest. It contained two eggs, and was of a very peculiar construction for a nest built in a tree, and looked more like the nests of such birds as build in a hole in a tree, as the ash-throated fly-catcher. It was small and composed of small twigs, grasses, vegetable fibers and down, loosely matted together, and with a small cavity pressed out in it. It was in the heart of the mistletoe and was not fastened to its branches, but laid on them and kept secure by the thick growth of the plant. The two eggs, considerably advanced in incubation, were very peculiar—of a slate-colored body ground, they were thickly marked all over with black spots, forming a dark ring around the center of the egg, which gradually shaded off at the larger end. They somewhat resemble the eggs of the cedar bird. The bird itself I did not recognize until I had shot and examined it. A peculiarity in its plumage, noticeable in flight, is the white color of the inner webs of the primaries; this, looking from beneath the bird while on the wing, gives a transparent look to half of the wings. Two eggs seem to be a small number for a full set, but they were nearly incubated and the cavity of the nest did not look as if it could contain more, so it may be the full number. Although I saw numbers of these birds at Tucson, yet it was later and I found no more nests.

The Arkansas fly-catcher *(Tyrannus verticalis)*—the Western bee-bird—is everywhere common. At Tucson I first found the nest and eggs, which cannot be distinguished from those of our *T. carolinensis.* The long-tailed chat *(Icteria longicauda)* is fully as common as our yellow-breasted chat, and is, in fact, too much like it to form a distinct species. Its nests, and eggs too, are identical with the yellow-breasted species. The little yellow warbler *(D. æstiva)* is abundant; and I was surprised to observe several pairs of redbirds *(Cardinalis virginianus)* around Tucson, and to find the nest of one pair. This seems to me an extreme western limit for the bird. The little Bell's vireo *(Vireo belli)* enlivened the solitude of the chaparral with its warble, short and sweet. I found numbers of its little pensile nests, like those of the warbling vireo *(Vireo gilvus)*, and all within a few feet of the ground. The set of eggs, three in number, are very like those of *V. gilvus*, but smaller and more pointed. Among the troupials, the hooded troupial *(Icterus cucullatus)* and the Bullock's troupial *(Icterus bullockii)* are the most common around Tucson, and the only ones whose nests I found. The hooded troupial builds a pensile nest composed entirely of grasses, and lined at the bottom with a few bunches of down. It is not unlike the nest of our orchard troupial. The eggs, three in number in every nest I found, are unlike those of the other troupials I have seen, but are marked with light and dark brown spots, chiefly around the larger end, and are of a bluish-white body color. The nests were all very thin, but firmly woven. A nest of the Bullock's troupial which I found a few miles out of Tucson, is a very beautiful and unique structure. It is composed entirely of different colored twine and yarn, horsehair and bits of paper, and so well and thickly is the horsehair woven in, that the nest is very stiff and substantial, and scarcely compressible. A bit of newspaper woven in the bottom of the nest, bears the words, "special attention," and is very appropriate. This nest contained five eggs, evidently a large set. They were of the size and shape of those of the Baltimore bird, but of a smoke color and thickly marked all over with lines and blotches, the lines forming a thick net-work around the larger end. The Carolina dove *(Zenaidura carolinensis)* is very numerous; and the white-winged dove *(Melopelia leucoptera)* was not uncommon, although not so abundant as back in the mountains where it breeds. I had the good fortune to find a nest of the little ground dove *(Chamæpelia passerina)*. I had seen several of these beautiful little doves, but did not know where to look for their nests, and only discovered this one by accident. It was situated between the horizontal forks of a limb about twenty feet from the ground, and consisted merely of a slight platform of grasses laid on the forks. It contained two small white eggs pointed at either end and marked inside with the lateral transparent lines peculiar to the eggs of the dove family when fresh. This situation of the nest was contrary to my preconceived ideas of it; the little dove, while nowhere common, is found throughout our southern borders. The short-legged pewee *(Contopus richardsonii)* does not seem to be rare throughout this southern country, but I only succeeded in finding one nest. It was saddled to a horizontal limb after the fashion of our wood pewee, and was composed of small twigs and grasses fastened together and to the limb with saliva, and was lined with finer grasses. The three eggs, well advanced in incubation, were of the size and shape of those of the wood pewee, and were of the same body color, but marked with some very large and some small reddish-brown blotches, chiefly around the middle of the egg. I also found a set of four eggs of another fly-catcher, the ash-throated fly-catcher *(Myiarchus mexicanus)*, the same day that I found the nest of the short-legged pewee. It was in a hole in a willow tree, and consisted merely of a bunch of matted hair and wool. The eggs are so like those of the great crested fly-catcher as to be almost indistinguishable. On another hunt shortly before leaving Tucson, I found nests and eggs of two more thrushes peculiar to this border fauna, viz: the crissal thrush *(Harporhynchus crissalis)* and the curve-billed thrush *(H. curvirostris)*. The former nest was situated in a low oak tree, a few feet from the ground, and was not large for the size of the bird. It was composed of coarse and small sticks, and was lined with fibers; the eggs, two in number and well incubated, were of the size and color of the robin's egg. The curve-billed thrush had nested in a tall cactus, and its nest was much larger and deeper than that of the *H. crissalis*; the cavity, in fact, was nearly four inches deep. The three eggs, about the size of the former, were of a light-green color, marked all over with fine red spots. Several other nests found the same day, but empty, were likewise in the cactus. A set of two eggs of the Western night-hawk *(Chordeiles henryi)*, found somewhat later, did not differ materially from the eggs of the *C. popetue*, and were laid on the bare ground beneath a bush. The birds are everywhere abundant.

I will now describe the nest and eggs of another minute species of the titmouse family, the verdin or yellow-headed titmouse *(Paroides flaviceps)*. I first observed the nests of these little birds on the Colorado desert, where, out of many I examined, only one was occupied, and that by fully fledged young. At Tucson, however, I succeeded in finding two nests of the second laying, with respectively three and four eggs in. Their nests are wonderful pieces of bird architecture, being often half the size of a man's head, and the builder scarce larger than a humming bird! They were each built at the end of a horizontal limb, and firmly woven around it; composed of thorny twigs well interwoven with grasses, vegetable fibers and mosses, and the interior compactly lined with down and feathers, not only on the bottom but all around the inner circumference of the nest. The entrances to these unique structures were at first invisible to me, so small and well concealed were they; placed at the top or on one side, they were either immediately under the supporting limb or the fabric of the nest above the hole was pulled down so as to conceal its presence. The little birds are very shy, and seldom show themselves except when they have young. The eggs in both nests were well incubated and I am convinced were all the birds were going to lay in that, their second nest. Five constitutes the full number in the first set, as proved by the five young birds I found on the desert. The nests, although generally situated within a few feet of the ground, were sometimes placed as high as twenty feet, and some, too, were placed between the forks of a cactus. The eggs are of a light-green color, varying in intensity in different specimens, and were marked with numerous fleckings of a golden-brown, more numerous around the larger end; they were of a scant half inch in length, and rather pointed.

Another bird peculiar to this fauna is the chapparal cock or road-runner *(Geococcyx californianus)*. This bird is wide-spread throughout the southern borders of our country, and its eggs are not rare in collections; but as to their number and the situation of the nest, there are contrary assertions. I have heard it said that two constituted the full set, and that one was laid some time before the other, after the occasional manner of the cuckoo; also that the nest was laid on the ground in the midst of a clump of cactus. I have seen a good many nests and heard from collectors in the localities of many more, and while occasionally placed in the cactus and rarely on the ground, the majority of the nests were in thick bushes; and in one case, as witnessed by myself, the nest was built on a thick horizontal mesquite limb, fully twelve feet from the ground. The nest, too, instead of being rude and imperfect, was rather neatly built of coarse sticks, and with the considerable cavity lined with grasses. The eggs in this nest

—pure white and about the size of a pigeon's egg—were five in number; two were considerably advanced in incubation, one was pipped and two were infertile. In another nest, found by a friend and authentic, were seven eggs, none so far incubated as to render blowing them difficult, and some infertile. I scarce know what inference to draw from these instances of a large number of eggs, but do not think the bird would raise so large a brood. Also the presence of infertile eggs in these nests where there were large numbers of eggs, seems to contradict the idea that they raise such a large brood. But why did they lay so many eggs? Perhaps some observer has explained, but I have never seen the explanation.

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EDITORS' TABLE.

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

—— Nomenclature is an essential part of language. Owing to the sense limitations under which we exist, objects must have names. So also must general concepts derived from objects have names. The one essential of naming is, of course, that distinct things shall have distinct names; and the second essential is, that each object or concept shall have but one name. These necessities become more and more urgent, as the number of known objects becomes greater. In order that each object and concept shall have but one name, cultivators of the natural sciences have determined to use that name which was first proposed with such a definition as shall enable them to ascertain the application intended by its author. All subsequent names are thus necessarily rejected as waste, to be forgotten as soon as possible. Moreover, names created for objects or concepts which are not defined, are rejected, as not being really proposed; for a name which is not applied to a stated object or concept, is quite as little nomenclature as an object or concept without a name. A name is, in fact, a short substitute for a definition, and where no definition[1] exists, there can be no name. Thus the rule of priority has become the *modus operandi* of nomenclature, and its only possible law.

Besides this practical necessity, an ethical element enters the question. The good opinion of the world is as much property as money and real estate. In fact, *it is* money and real estate.

[1] It is evident that definitions must often, in the early stages of a subject, be imperfect. But even a bad definition conforms to the necessary rule.

It is just that every man should be valued at his true worth, and should have the opportunity of securing a just valuation at the hands of his cotemporaries. Mental products are prime elements in this valuation; so are labors undergone, and sacrifices submitted to. Intellectual products are unquestionably property, and he who attempts to pass off the results of other men's labors as his own, is as much a thief as he who picks a pocket, or burglariously enters a house. Now when nomenclature represents original ideas, the two conditions of equity and convenience are fulfilled. From this we draw the conclusion, that it is well for producers of ideas to create nomenclature, and that non-producers should avoid it.

The habit of giving credit to others for their ideas is a concomitant of increased numbers and near contact of producers, like any other evidence of civilization. The habit of justice is maintained by the mutual pressure of interests; and knowledge of each other's work is readily obtained through easy intercommunication. Right is a natural element which develops under agitation, and perishes by neglect. All interests contribute to it. No one desires to be thought to plagiarize; but where credit for the ideas of others is not given, plagiarism may be suspected. Hence in some cases, pride, if not benevolence, will prompt to justice. It is indeed true that the same ideas occur independently to different men in different places. But it will always be difficult in these days of wide and ready distribution, for the later producer to know or show how much he may not have been influenced by his predecessor in the field.

The comparative isolation of some of the centers of scientific production in the United States, and the small number of persons so occupied in many of these localities, renders us especially liable to the faults implied in the above remarks, and this in spite of the fact that, for our population, we hold as a nation, a very respectable position in the world of scientific work and thought. Whether it be from the lack of international competition on this continent or not, national pride does not yet seem to be sufficient to induce many Americans to credit their countrymen with their productions, but will attach them too often to foreign names, or will reproduce them, as though absolutely new. A striking instance of this regardlessness occurs to us in the quadruple nomenclature of the geological formations of the center of this continent. After Dr. Hayden, supplemented by Mr. King, had named and classified the geological horizons of the West, Major Powell, in order to have "a new slate," proceeds to ignore the greater part of this work, and names an extensive series of them over again. Soon after, Mr. King, assuming the rôle of a palæogeographer, names the great inland lakes which successively occupied tracts of our continent. Of course the sediments of these lakes had already received names, which are of necessity applicable to the bodies of water which deposited them. Such use is universal in Europe, and the proposition of the new nomenclature by Mr. King, is scarcely more defensible than the proceedings of Powell. But the conclusion was not yet reached. Professor Marsh coolly putting aside all this work of his predecessors, *re-names the entire series* from the period of the beginning of vertebrate life to the present time. He selects names from characteristic genera of fossils, in itself a good basis of nomenclature, but, in this case, utterly uncalled for.

We may soon look back on this stage of our scientific development as presenting some characteristics of the beginning of the century in Europe. The necessities of progress will doubtless early correct any tendency to neglect or ignore just claims wherever found.

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RECENT LITERATURE.

Zittell's Hand-book of Palæontology.[1]—While the recent death of Professor Schimper was a great loss to science, it must also prove a serious blow to Professor Zittell, who was aided by the learned fossil botanist in the preparation of the botanical portion of his Palæontology. The part before us is much thinner than the first, and although no intimation is given by the publishers, we suppose that this is the last part which will appear from the pen of Professor Schimper, and that some one else will carry on the botanical part of the work.

This second part completes the ferns and Rhizocarpeæ, and contains the account of the Calamarieæ, Lycopodiaceæ, and the Phanerogameæ, including the Cycadeaceæ, the part completing the account of this first order of Cycads. It will thus be seen that the author before his death had elaborated the larger tree-like Cryptogams of the coal period, so that this part is of special interest and value to students, and especially teachers. The account of Calamites and its allies is preceded by a general account of the living Equisetaceæ, and figures with which may be advantageously compared those illustrating the restoration of Calamites; so that we obtain a tolerably clear notion of the appearance of these gigantic fossil horsetails of the coal period. Under the head of Calamocladus, the branches and whorled leaves of the Calamites, originally described under the name of Asterophyllites, are figured and described. Antennularia is next described; then Asterophyllum as restricted by Schimper, and other forms, as well as details of fructification which are doubtfully regarded as parts of different species of Calamites, but allowed to stand under various generic names.

The giant club-mosses, Lepidodendron, Sigillaria, etc., are then

[1] *Handbuch der Palæontology*, unter mitwirkung von W. Ph. Schimper, herausgegeben von Karl A. Zittell. II. Band II. Lieferung. Mit 49 original-holzschnitten. München und Leipzig, 1880. 8vo, pp. 153–232.

treated in the same comparative and suggestive way, with excellent figures, showing the restoration of these forms from Zittel's work, "Aus der Urzeit," together with figures of allied forms, and drawings illustrating their histology. The table on page 209, giving a comparative sketch of the morphological and anatomical characteristics of Sigillaria, Lepidodendron, Isoëtes and the Cycadeæ, summarizes these points in a graphic manner.

It should be borne in mind that this work is the result of extensive personal research by the authors in collecting materials expressly for the results here given, and is not merely a compilation; thus the treatise is fresh, authentic, and therefore indispensable to those only familiar with the general popular works of Nicholson, and the older works of Owen, Pictet, and the palæontological portions of Lyell, Dana and other geological authors.

GÜNTHER'S INTRODUCTION TO THE STUDY OF FISHES.[1]—No living man has so large an acquaintance with the species of recent fishes as Dr. Günther, and his works on Ichthyology are a *sine qua non* of every zoölogist's library. The author of these is not more distinguished for his wide learning in this and other fields, than for his conscientiousness in certain points of nomenclature. While sustaining the law of priority in specific and generic names, he has always done so with the condition that those names should represent something in order to become available. For *nomina nuda* he has had no respect, and he has been one of the most stalwart of those who have doubtless prevented the natural sciences from being buried beneath a load of nomenclatorial rubbish. The naturalists of the future will scarcely know the debt they owe to those who have taken this logical position, and will hardly credit the assertion that there was once a period in the history of their science when persons sought to be esteemed scientific, by the mere creation and proposal of names. Dr. Günther and his co-workers have had to take care, that the popular recognition usually accorded to name-makers, shall not affect the virtue of the true scientist; and that the coin of their science shall consist of golden ideas, and not of empty words.

The portion of this work devoted to the anatomy of fishes covers 192 pages, and is very full and well illustrated. It forms the best manual of the subject in existence. A short chapter on the geological distribution of fishes follows, which is of little value. The section treating of the geographical and hypsometrical distribution is extensive and valuable. Here will be found an account of the deep-sea fishes, etc., a most interesting subject, to which Dr. Günther has contributed more than all other ichthyologists combined. The systematic portion occupies the remainder of the book. Here can be found extensive reference to

[1] An Introduction to the Study of Fishes, by Albert Günther, Keeper of the Zoölogical Department of the British Museum. 8vo. Edinburgh, Adam and Charles Black. 1880. pp. 720.

most of the leading genera of fishes, with diagnoses of the families and higher divisions as understood by Dr. Günther, with many good illustrations. While this part of the work will always be most valuable to the student, it remains to point out two radical defects. In the first place, the systematic classification is anything but a just reflection of the structural likenesses and unlikenesses found in nature, combining as it does all the faults of the older authors, some of which are crystallized into a new error of the learned author's own creation. We allude to his subclass of *Palæichthyes*, which is a triumph of systematic *gaucherie*. The second deficiency of which we complain, is the wonderful ignorance of North American Ichthyology displayed in the book. It is scarcely necessary to enter into detailed criticism of this part of the subject. We summarize by saying that the book has no value whatever as representing North American Ichthyology, and can only be read by the student here, as a systematic text-book, with reference to exotic species and genera.

BRÜHL'S ZOÖTOMY FOR STUDENTS.[1]—We have often wanted some work giving sketches, with each part identified, of the anatomy of common types, especially of vertebrates. It will be difficult for the student to find in any single book, not excepting Owen's anatomy of the vertebrate animal, good, detailed figures of the common salamanders, lizards, birds or mammals. We therefore subscribed to Brühl's Zoötomy, and have found the parts as issued so useful for the purpose stated, that we unhesitatingly recommend it to teachers as the cheapest and fullest atlas of comparative anatomy with which we are acquainted. Twenty parts have been published, of which five have appeared during the past year. They comprise among other illustrations the osteology and visceral anatomy of the fowl and other birds, different fishes, reptiles and the osteology and brains of the apes, the latter given with sufficient fullness. The five parts issued lately illustrate the osteology of the Lepidosiren, Protopterus, Ceratodus, Chimæra, Callorhynchus, *Rana pipiens*, and of different turtles, the details being abundant, and evidently well drawn from nature. Very few of the figures are copied from other authors, and appear to be reliable, though we have not compared them with original preparations. The author is Professor of Zoötomy in the University of Vienna. Further information is given in the title below.

INGERSOLL'S FRIENDS WORTH KNOWING.[2]—Boys and girls are, in this little book, treated to glimpses of snails, birds, wild mice, and then taken out to the plains and shown by word and pictures the

[1] *Zoötomie aller Thierklassen für Lernende*, nach Autopsien, skizzert von CARL B. BRUHL. Illustrirt durch Zweihundert Tafeln, mit nahe 4000, von Verfasser meist nach der natur gezeichneten und sammtlich von ihm mit dem diamant in Stein radirten Figuren, Atlas in 50 Lieferungen zu 4 Tafeln. Wien, 1879, 8vo. Alfred Hölder, New York, B. Westermann & Co.

[2] *Friends Worth Knowing*. Glimpses of American Natural History. By ERNEST INGERSOLL. Illustrated. New York, 1881, 12mo, pp. 258.

haunts and habits of the buffalo. Such pleasant reading as this, illustrated as the text is by uniformly attractive wood-cuts, most of them of much artistic excellence, is just what is wanted for young people. Particularly adapted to this end are the chapters entitled, "In a snailery," "Wild mice," "Our winter birds," and "First comers." "An ornithological lecture" will, we think, hold closely the attention of young readers and is written in the author's happiest vein. The effect of the book will be not only to interest the reader in the story so pleasantly told, but when next summer he meets with snails, frightens the wild mouse from its nest, or hears the notes of the thrush or song-sparrow, or sees the yellow birds gather about the thistle, he will not only recall the ornithological lecture he or she has read, but desire to learn for himself or herself more about the beautiful, attractive forms enlivening the woodlands and meadows, or peopling the shrubbery or orchards near the house.

GENNADIOS ON PHYLLOXERA.[1]—This is a small volume of seventy-eight pages in 12mo, divided in eleven chapters, of which the first nine review the origin and natural history of the insect and the remedies employed in other countries for the prevention of its ravages. The tenth chapter points out the great danger to Greece from importation of infected vines and the insufficiency of the existing laws on the subject. There is nothing new in the book, it being compiled from the writings of Planchon, Lichtenstein and Riley; the latter's figures, which have already done good service abroad, being rather poorly reproduced. It is the first work on the subject in modern Greek that has come to our notice.

WOOD'S INSECTS ABROAD.[2]—The title of this book is somewhat misleading in a work published here, as many of the insects figured and described are common American species. This is explained by the fact that the book first made its appearance in 1874, in London, and treats of insects which are exotic from that standpoint. It is, however, an interesting book, and the author, through having access to the collections of the British Museum, has been enabled to present figures of many of the rare and curious treasures there preserved. The work is so pleasing in appearance and so entertaining withal that we regret to feel obliged to mention the presence of many typographical errors and to put our readers on their guard against placing too much confidence in some of the statements contained in the text.

RECENT BOOKS AND PAMPHLETS.—Orange Insects. By Wm. H. Ashmead. 8vo, pp. 78, pls. 4. Jacksonville, 1880. From the author.

Notice of recent additions to the marine invertebrata of the northeastern coast of

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[1] *The Destructive Phylloxera.* By P. GENNADIOS. Athens, Greece, 1879.

[2] *Insects Abroad.* A companion volume to "Insects at Home." Being a popular account of foreign insects, their structure, habits and transformations. By the Rev. J. G. WOOD, M.A., F.R.S., etc. New York, George Routledge & Sons. 8vo, pp. xii, 780, with 520 figures.

America, with descriptions of new genera and species and critical remarks on others. Part II. Mollusca, with notes on Annelids, Echinodermata, etc., collected by the U. S. Fish Commission. Part III. Catalogue of Mollusca recently added to the fauna of Southern New England. By A. E. Verrill. Washington, D. C. (From the Proceedings of the U. S. National Museum, III. Printed Dec., 1880, and Jan., 1881.) 8vo, pp. 335–410.

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Notes on some new or little known North American Limnæidæ, pp. 8.—

On the Geographical Distribution of certain fresh-water Mollusks of North America, and the probable cause of their variation, pp. 8.—

Some notes on American Land Shells, pp. 8.—

Remarks on the Trenton Limestone of Kentucky, pp. 17, pl. 1.—

Descriptions of Crinoids from the Upper Sub-carboniferous of Pulaski county, Kentucky, pp. 7, pl. 1.—

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Note sur la ponte du Pleurodèle de Waltl observée à la Ménagerie des Reptiles du Muséum d'Histoire naturelle, pp. 18. (Ext. du Bull. de la Soc. Phil. de Paris, 1880.)—

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GENERAL NOTES.

BOTANY.[1]

Variations in the Growth of Virginia Creeper and Hickory.—It is well known that no two plants ever grow exactly alike, though these variations are often very slight. Two instances have come under my observation which have interested me very much, though they may be familiar enough to botanists. The first relates to our beautiful indigenous climbing shrub, the Virginia Creeper (*Ampelopsis quinquefolia*), several of which I have transplanted from the neighboring forest to the grounds about my residence. Some of these specimens are very free growers, climbing a dozen feet during a season, having joints three to four or five inches long, and large widely expanded leaves; the tendrils in these are very long and similar to those of the wild grape. Others have very different habits of growth; the joints are quite short, not more than one to two inches long, and the growth of the whole plant is very slow as compared with the first-mentioned variety. The tendrils, too, are very short. In some instances the stems send out aerial roots which burrow into the bark of the supporting tree, after the manner of the Poison Ivy (*Rhus toxicodendron*). The long-jointed free-grower never sends out these aerial roots, but depends for its support upon its tendrils which soon become dry and hard, and as tough as little wires.

The other instance refers to our common shellbark hickory (*Carya alba*). In the spring some of the trees may be seen with bursting buds and even expanding leaves while the buds of other trees standing close at hand are dormant and remain so for many days. In autumn these differences are also quite as marked; the leaves on some of the trees ripen and shrivel up even some days before any frosts, turning to a dark gray or slate color. Upon other trees the leaves continue green until the first frosts; they then turn yellow, with something of the same beautiful tints of the hard maple, and remain so until the heavier frosts completely dissipate their golden glories.—*Chas. Aldrich, Webster City, Iowa.*

The Compositæ—Dr. Gray, in his last "Contributions to North American Botany," issued September, 1880, from the Proc. Am. Acad. Arts and Sciences, takes a considerable space to speak of "some of the results already reached" in the elaboration of the Compositæ for the forthcoming "Synoptical Flora of North America." As the portion of that work in which this order will be included cannot be published for some time, it may be well to sketch the more important of these results. Under the genus Venonia, the species *V. altissima* of Nuttall, long considered to be a variety of *V. fasciculata*, is restored to full specific rank. Elliott's name, *Eupatorium parviflorum*, gives way to Hooker's *E.*

[1] Edited by Prof. C. E. Bessey, Ames, Iowa.

ambiguum. The genus Aplopappus is greatly extended, including the old genera Prionopsis, Eriocarpum, Pyrrocoma, Homopappus, Sideranthus, Isopappus, Stenotus, Ericameria and Macronema. The five species of Aphanostephus and the seventeen species of Townsendia are briefly characterized, and a systematic synopsis is given in each case. In discussing the genus Erigeron the author says: "It can be limited only by taking into account a combination of characters, and insisting here upon one, and there upon another." *Aster graminifolius*, of Gray's Manual, is hereafter to be known as *Erigeron hyssopifolius*. *Erigeron vernum* is likewise changed to *E. nudicaulis.* The genus Aster is accepted in the wide extent assigned it by Bentham and Hooker in the Genera Plantarum. The revision of this genus is not yet completed, but enough has been done to indicate that there will be but little change made in it as we have known it in Dr. Gray's works heretofore. The remainder of the order is still to be revised.

The Sensitiveness of the Root-tip of the Seedling.—We believe that there is no structure in plants more wonderful, as far as its functions are concerned, than the tip of the radicle. If the tip be lightly pressed or burnt or cut, it transmits an influence to the upper adjoining part, causing it to bend away from the affected side; and what is still more surprising, the tip can distinguish between a slightly harder and a softer object by which it is simultaneously pressed on opposite sides. If, however, the radicle is pressed by a similar object a little above the tip, the pressed part does not transmit any influence to the more distant parts, but bends abruptly towards the object. If the tip perceives the air to be moister on one side than the other, it likewise transmits an influence to the upper adjoining part, which bends toward the source of moisture. When the tip is excited by light, the adjoining part bends from the light; but when excited by gravitation, the same part bends towards the center of gravity.—*Darwin's "The Power of Movement in Plants."*

Influence of Light on the Respiration of Seeds.—Planchon read a paper before the Paris Academy of Sciences, at its meeting on Nov. 22d, detailing experiments upon this subject. The experiments were made on the castor-oil plant and the bean (Phaseolus). As in previous experiments, a good deal more oxygen was observed in light than in darkness. The castor-oil seeds exhale slightly more CO_2 in darkness than in light, but the opposite was the case with the seed of the bean. In darkness the ratio of CO_2 to O was for the bean at least one-third superior to that for the castor-oil plant, but prolongation of the experiment tends to bring the relation equal to unity, whatever the original value. For a given quantity of oxygen absorbed, the seed placed in darkness exhales more CO_2 than that kept in light. While in light there is always less CO_2 exhaled than oxygen absorbed, the contrary occurs in darkness. These facts explain the transformation of legumin into asparagin.—*Nature.*

Botanical Notes.—In recent numbers of *Nuovo Giornale Botanico Italiano,* Caldesi has been publishing a catalogue of the plants of Fænza and vicinity. It is fully annotated and contains many references and synonyms. There are many names in the list which are familiar to even local botanists in this country, as witness the following: *Asclepias cornuti, Calystegia sepium, Scrophularia nodosa, Veronica anagallis, V. officinalis, Brunella vulgaris, Typha latifolia, T. angustifolia, Juncus effusus, J. bufonius, Eleocharis palustris, Phragmites communis, Poa pratensis, P. compressa, Equisetum arvense, E. palustre, Adiantum capillus-veneris, Pteris aquilina, Polypodium vulgare,* etc. Among the weeds are the following familiar names: *Panicum crus-galli, P. sanguinale, P. glabrum, Setaria glauca, S. viridis, Urtica dioica, Amarantus retroflexus, Chenopodium album, Verbascum thapsus,* etc. Many plants which with us are cultivated for their flowers, or for other purposes, find a place in this catalogue as wild or naturalized species, *e. g., Euphorbia cyparissias, Iris germanica, Colchicum autumnale, Hyacinthus orientalis, Ornithogalum umbellatum.* A new species of Orobanche *(O. pelargonii),* is described; it is parasitic upon *Pelargonium inquinans.* The glumaceous plants are very unequally divided between the sedges and grasses, there being but twenty-one of the former, while of the latter there are no less than ninety-eight.——A new Alga is described and figured in the November number of the same journal by Borzì. It is regarded as the type of a new genus, Hauckia, related to Cosmocladium. The cells, which are two and two, are in the ends or sides of hyaline erect or curved stalks. Each cell by fission produces two daughter cells, and the latter develop hyaline stalks, thus giving rise to a repeatedly bifurcating mass. Macro and micro-zoöspores are also produced by the successive division of certain cells into two, four and eight parts, each provided with two vibrating cilia. No conjugation has been observed; on the contrary, both forms of zoöspores were seen to germinate. The species is named *Hauckia insularis.*——According to a correspondent of the *Gardener's Monthly, Caladium esculentum* has escaped from cultivation in some portions of Texas, and run wild.——E. W. Greene describes several new species of plants from New Mexico in the January *Botanical Gazette.*——In the same journal J. Schenck records his observations upon seventeen chestnut trees in Wabash county, Ill., which were planted many years ago by the early settlers. Where the trees are in groups of two or more they have invariably been fruitful, but whenever they are isolated they as a rule produce nothing but empty burs, indicating that the flowers need to be cross-fertilized *from tree to tree.*——In recently excavating a dock at Bombay, India, a forest bed was found composed of 382 trees, of which no less than 223 were in a standing posture. The largest tree was forty-six feet long and four feet and a half in circumference. The trees were generally found in a dark loamy soil composed of the disintegrated underlying rocks at a depth varying from low-water mark, to sixteen feet below low water.——It is encouraging to notice the improved facilities for botanical study and teaching in our colleges. At Michigan Agricultural College, a building 46 by 66 feet, and two-stories in height was erected in 1879, for the department of botany. The large lecture-room, 44 by 48 feet, is provided with tables for laboratory uses also. A large room on the second floor is designed for the herbarium and cabinet. At the Iowa Agricultural College new and more commodious rooms were provided for the botanical department by the erection of North Hall, in 1880. A large lecture-room is supplemented by a laboratory adjacent to it. The latter is constructed with north and east windows for microscopic work. A third room of ample size is set apart for the herbarium and cabinet.——Ten new species of Carices are described in the recently published second volume of the "Botany of California," by Wm. Boott, who contributed the article on Carex.——M. E. Jones in an article on the wild fruits of Utah, in Case's *Botanical Index*, mentions fourteen species; among these is a curious wild peach which grows in the sand and on lava beds. A wild gooseberry, *Ribes divaricatum*, var. *irriguum*, and a raspberry, *Rubus leucodermis*, would probably be hardy in the Eastern States; their fruits are described as delicious.

ZOÖLOGY.

Dredgings in the Bay of Biscay.—The following are some of the more important results to which M. A. Milne Edwards directs attention. The Crustaceæ were, he says, extremely interesting; not one of the specimens dredged is also littoral in habitat, and it seems as though there were two faunæ placed one above the other, and not mixing. He forms a new genus, Scyramathia to contain *Amathia carpenteri* and *Scyra umbonata*; a crab with phosphorescent eyes was found at various depths between 700 m. and 1300 m. *(Geryon tridens)*; this has been already seen in the Norwegian seas. *Munida tenuimana*, with large and phosphorescent eyes was not rare. *Gnathophausia zœa*, which has only as yet been collected by the *Challenger* (off the Azores and near Brazil) was also met with.

Most of the Mollusca belong to the deep-sea fauna of the North Atlantic and of the Arctic seas. Among the Mediterranean forms, there were some which as yet have only been found in the fossil state. The similarity of the deep-sea fauna at different latitudes is very strikingly shown by this collection. Pteropoda were taken from all depths; indications of Heteropoda were not absent. A short list of the more important Mollusca obtained is given by M. Milne Edwards in a foot note.

Chætopod worms were abundant at all the stations; a species of the remarkable Chætoderma was also taken; two or three genera of Gephyrea were met with, and several of the forms had a resemblance to the Arctic species.

A new species of Edwardsia (or Hyanthus), a beautiful red Adamsia, a large Bunodes, and a new species of Flabellum represent the most striking Zoantharia; the Alcyonaria are reported to be very remarkable, and among them was a specimen of the rare Umbellularia.

The Echinodermata appear to form the most valuable part of the collection; there is a new species of Phormosoma, which is to be distinguished from *P. placenta* by the ornamentation of the plates, and by its large spines on the oral surface, *Pourtalesia jeffreysii.* Two new and remarkable Spatangoids make up the chief Echinid gains. The Asterida were all interesting and rare, but above all we have to note the capture of *Brisinga coronata*, which was taken at several stations. Among the Ophiurids, which were abundant, there was found one which, not described, is said to be probably the representative of an absolutely new type. There are some new and fine species of Holothurioida. Among the Crinoids we find only two examples of an Antedon, allied to *A. sarsii* of the Northern seas. Hyalonema, Holtenia, Farrea, &c., were among the siliceous sponges.

Large specimens of *Orbitolites tenuissima* and a magnificent series of arenaceous forms are to be noted among the Foraminifera.

In some cases the dredge descended to 3000 metres, and in addition to the zoölogical collections, there have been made observations of very considerable importance on the hydrographical relations of the sea-bottom of this region.

Fauna of the Luray and Newmarket Caves, Virginia.—Last June I visited these caves in order to compare their fauna with that of Weyer's cave, situated farther south in the Shenandoah valley, which I had examined in 1874, with excellent results, having found between fifteen and twenty species of Arthropods, where no life had before been known to exist.

Newmarket cave, situated about three miles south of Newmarket, was first visited, and a hasty examination revealed the following forms:

Spirostrephon copei Pack. Several specimens prove to be exactly like those from Weyer's cave; individuals from the two caves (as well as from Luray cave) only differing from those of Mammoth cave, Ky., in having shorter hairs.

Linyphia. Webs of a small spider, probably *L. weyeri* Emerton, were common on the stalactites, but the spiders themselves were not detected. A small, long, narrow mite also occurred, and what is probably a new species and genus of false scorpions; it was blind, and quite different from Mammoth cave specimens of *Chthonius packardi* Hagen.

Among insects a single cricket (*Ceuthophilus maculatus* Harris) occurred not far from the entrance, and a beetle with eyes (Cryptophagus sp. indet.) which had probably been carried in by the men at work on the stairways and walks; also two small flies, while the true cavern fly which we have found in caves in Kentucky, Indiana and Utah was common; we refer to *Blepharoptera defessa* Ostensacken. Of Thysanura, two species occurred; a pale whitish-red Smythurus, with pale reddish eyes, and faded whitish specimens of *Tomocerus plumbeus* (Linn.) of the same color and appearance as those collected by us in the Carter caves, Kentucky. The body was nearly white, the antennæ darker, the eyes black.

The Luray caves, in Luray valley, were less populous in the parts fitted up for visitors, owing undoubtedly to the recent walks and stairways built by the proprietors. Spiders were numerous, however, all belonging to one species, *Linyphia weyeri* Emerton; they differed only from the type specimens in having rather smaller eyes. *Spirostrephon copei* was less common than in the Newmarket cave. The fauna of these caves was essentially like that of Weyer's cave. The writer would add that he is collecting materials and intends soon to publish a monographic account of the cavé fauna of the United States, in the reports of the Kentucky Geological Survey, under whose auspices most of the material has been collected; and would be grateful for the loan of specimens.—*A. S. Packard, Jr.*

A Rare Fish in Illinois.—A specimen of Chologaster in the collection of the Illinois State Laboratory of Natural History, was obtained by Mr. F. S. Earle, of Cobden, Illinois, in August, 1878, from a spring at the foot of a bluff, in Western Union county, in the southern part of Illinois.

The description of *Chologaster cornutus* Agassiz, was based on three specimens from South Carolina, and that of *C. agassizii* Putnam, on one from Tennessee;—these four specimens being apparently all that were known at the time of the publication of Mr. F. W. Putnam's synopsis of Heteropygii, in 1871.

The Illinois specimen differs materially from the others, but as it is intermediate in several particulars between the two described species, and as specific descriptions drawn from so small a number of individuals must have a very uncertain value, I will give an account of this specimen prepared by comparison with the descriptions of Putnam's synopsis, without attempting to decide whether it belongs to a new species or whether it unites the two previously proposed. Head in body, without tail, 3½ times; the eye is above and well behind maxillaries and is contained about six times in head; the pectoral fin reaches half way to the dorsal; the color is precisely as in *cornutus*, except that the middle stripe, dark on the head, is decidedly *paler* than the ground color on the body, the change being abrupt at the opercular margin. The caudal fin is dark-brown, with several rows of white specks or blotches running across the rays. The anterior part of the dorsal is similar in color, but paler. Total length a trifle over an inch. A scale from the region mentioned by Mr. Putnam, is similar to that of Agassizii, but shows five or six concentric lines and three radiating furrows.

This specimen thus agrees with *C. cornutus* in position of eye and plan of markings; with *C. agassizii* in length of pectorals and structure of scales; is intermediate in length of head, and agrees with neither in the color of the caudal and dorsal fins and the tint of the middle band.—*S. A. Forbes, Normal, Ill., Jan.* 3, 1881.

The Japanese Lap-dog.—This species of *Canidæ* was characterized in the Proceedings of the Philadelphia Academy for 1879 (July), under the name of *Dysodus pravus*, and the diagnosis was based on four skulls and one skeleton. In the Naturalist, for 1879, p. 655, appeared notes on three living specimens examined by the writer in San Francisco, which confirmed the characters previously ascribed to the genus and species. Subsequently I had the opportunity of examining eight additional specimens in San Francisco, of which three were born there, and two certainly and others are probably, Japanese born. The characters of these are as follows:

No. 1. Premolars $\frac{2}{2}$, molars $\frac{1}{2}$; first premolar a minute cusp; two years old; Japanese.
No. 2. Premolars $\frac{3}{3}$; first and second superior minute.
No. 3. Premolars $\frac{4}{3}$; first and second superior minute cusps; first inferior do.; nine months old; American born.
Nos. 4 and 5. Exactly like No. 3.
No. 6. Premolars $\frac{2}{2}$; an old dog from Japan.
No. 7. Premolars $\frac{2}{3}$; young; daughter of No. 6.
No. 8. One-half poodle; premolars $\frac{2}{2}$; molars $\frac{1}{2}$; four and a half years old.

From the above it can be seen that the absence of the first inferior premolar is constant, as is also, I may add, the absence of the last inferior true molar. In only three specimens was the first superior premolar present, and then as a cusp-like rudiment; and these are young dogs American born. The tooth is doubtless shed before maturity. Finally, even the poodle mixture did not restore the two lost inferior molars; and two superior molars are also missing, as in the typical *Dysodus pravus*. In all, the superior incisor teeth were present. Thus, though this species shows a remarkable tendency to shed the molar teeth with age, its normal dentition, when perfectly preserved, differs materially from that of the genus *Canis*.

This species has some marked peculiarities of habits. It does not appear to possess the senses of sight or smell in the same degree as the species of *Canis*. It cannot follow its master through a crowded street, and is readily lost, even on open ground where opportunities for sight are good. As house dogs they are cleanly, and intelligent in certain directions. They do not learn tricks easily, but seem to understand the disposition and wishes of their master very readily. They are often very vivacious and energetic, and not at all indisposed to use their canine and flesh teeth on persons whom they do not especially regard. —*E. D. Cope.*

THE EPIDEMIC AMONG MARINE FISHES.—In the year 1878 the pages of *Forest and Stream*, as also the Proceedings of the National Museum, contained notices of a remarkable mortality among the fishes and marine animals of the Gulf of Mexico, the quantity of fish perishing being something truly enormous. This year the same phenomenon is repeated and the Florida papers contain many notices on the subject.

It is considered a matter of so much importance that the National Board of Health has detailed Doctor Ginteras to visit the region and make a thorough investigation in regard to it.

Among the various communications that have reached the Smithsonian Institution, I inclose one of the most detailed, from an extremely intelligent observer, a resident on the west coast of Florida. At present the cause of the evil is unknown, but a careful comparison of the data, supplemented by the special investigations of the Board of Health, may enable us to solve the problem. The occasion is a very serious one to the fishermen, and indeed to the people of the Gulf coast generally, as a vast amount of animal life, cast in a putrifying condition on the shores, must be a source of injury to the public health.

It is desirable that any observations of facts connected with this phenomenon should be published.

SPENCER F. BAIRD, *Commissioner.*

Statement of Mrs. Charles Hoy, of Little Manatee: "The fish began dying here about the first of November. About 8 o'clock on the evening of October 28, or thereabout, I was sitting on my front gallery, the air being perfectly still, and the bay calm, when I heard a heavy splashing of the water in the direction of Gadsden point. This continued for a few minutes, and was immediately followed by a roaring sound, such as might be made by the wheels of a side-wheel steamer near at hand, though the noise seemed to be several miles away. This continued for about a quarter of an hour, as near as I could guess, when it suddenly ceased. Some twenty-five or thirty minutes afterward, heavy swells began to come up the river, such as come in during a heavy blow from the north-west. These continued for a long time, gradually becoming lighter until I went to bed. In three days the fish began to come up the river dead and dying. I caught several mullet that were standing upright in the water sick, and each had three black spots on the back, which gradually faded away. I opened the fish, and could see nothing the matter with them. The flesh was natural and firm, and the gills were normal.

"In regard to oysters I have had a rather rough experience, and can with certainty say that they are poisonous. A few days after the fish began dying, I had a quart of fine oysters for dinner. I had a lady visitor on that day, but she did not like oysters, and ate none. My daughter and I ate heartily of them, and after dinner I took my gun and went out to a pond to shoot some ducks. I took a colored woman (my cook) along, and before I had gotten half way I began to feel weak, and a mist came before my eyes. I kept on, however, to the pond, and when I reached it, I was so blind I could not see the ducks, although the water was covered with them. With the assistance of the colored woman, I got home, when I found my daughter similarly affected, and unable to walk. Neither Mrs. Simms, the visitor, nor my cook were affected, which makes me know it was the oysters. The sickness and loss of vision gradually left us after drinking a cup of strong coffee. I am confident the death of the fish is caused by the discharge of poisonous gases from the bottom of the sea."—*Forest and Stream.*

CARACAS (Venezuela), November 12, 1880.

THE LAC INSECT.—In addition to Mr. J. M. Stillman's article on "The origin of the Lac," (AMER. NAT., Nov. 1880, p. 782-787). I may be allowed to say that H. L. Carter published a rather full life-history of the Lac insect in the *Annals and Magazine of Natural History*, 1861. There exists also a special work, by J. E. O'Conor, under the title "Lac; production, manufacture and trade," a revised edition of which was printed in Calcutta in 1876, 8vo, pp. 83. It contains Carter's article in the appendix. Both confirm of course Mr. Stillman's observation that the lac is a secretion of the insect, and O'Conor mentions thirty-five trees on which it has been found. The best lac is said to be found on the *Butea frondosa*, *Ficus religiosa* and *Schleichera trijuga*.

I think Messrs. Trübner & Co., 57 and 59 Ludgate Hill, London, can furnish O'Conor's book, which is one of the official publications of the Indian government. In the number for September, 1880 (page 669) of the AMERICAN NATURALIST, my article on the fertilization of *Cobæa penduliflora* (published in *Nature*, June 17, 1880), is mentioned; but with the curious addition, that it "confirms Bonnier's statement that the nectar is of no direct use to the plant." Now Bonnier, as is well known, holds just the opposite opinion, whilst I certainly gave the case of the *Cobæa* as a relevant proof against the view he has lately tried to defend in the botanical part of the *Annales des Sciences Naturelles.*—*A. Ernst.*

DEEP-WATER FAUNA OF THE SWISS LAKES.—Dr. Asper gives a brief account of his investigations into the fauna of eleven of the Swiss lakes.

That of the Lake of Zurich would appear to be very rich. The Mollusca are represented by various genera, and those delicate Cyclads, the Pisidia, are always present. The larvæ of Diptera were also numerous. Living in small tubes formed from the slime, they are either colorless or of an intense yellow or red color; they chiefly belong to the genera Chironomus and Tanypus. Acarida were nowhere completely absent. Vermes were richly represented, and chiefly by species of Lumbriculus and Sœnuris. Of the latter genus great quantities were observed. There was also a colorless Hydra. In the Lake of Luzerne seventy specimens of what appears to be *Asellus forelii* were taken at one dredging. Here, again, Lumbriculids and Dipterous larvæ were very abundant. In the Lake of Sils (Engadine), to omit many points of interest in other lakes, the Hydroids appear to be especially remarkable. A new species is described and figured by the author under the name of *Hydra rhœtica.* Of a bright red color, and often as much as 1½ cm. in size, it gives indications of forming buds which remain permanently attached to it, and so give rise to a colony. The male and female individuals can be easily distinguished. The fauna of this lake was very rich in individuals, though comparatively poor in species.—*Jour. R. Microscopic Society.*

The Poison Apparatus of Spiders.—M. Jules MacLeod has recently published in the Belgian Archives de Biologie, the results of his studies on this subject. He finds that each of the venomous glands of spiders is formed of a pyriform sac, the walls of which, provided with a muscular layer, are lined within with an epithelium, the cavity of which serves as a reservoir of the poisonous fluid. From the anterior part of this sac proceeds a canal which opens at the end of the cheliceres, or jaws. The wall of this canal contains the same parts as the wall of the sac, but the muscular layer is there, however, either much less developed or absent. The secretory cells are cylindrical, arranged in a single layer. These cells present a different aspect according to their state of repose or activity; they pass from the state of ordinary cylindrical cells (repose?) to that of cup-shaped cells (activity?) by a series of states of passage. In certain species there are only cup-shaped cells (Tegenaria), of which the cup, much elongated, plays the rôle of excretory canal.

This last form approaches the typical unicellular glands; consequently the glands whose cells presents this disposition are, properly speaking, compound glands (Tegenaria).

Deep Dredgings in the Lake of Tiberias.—The invertebrata obtained by M. Lortet in these dredgings include ten species of Mollusca, of which three are new to science. These are named by M. Locard, *Unio lorteti, U. pietri, U. maris galilæi.* The other species are *Unio terminalis* and *tigridis, Cyrena fluminalis, Neritina jordani, Melania tuberculata, Melanopsis præmorsa* and *costata.* The three latter shells give the fauna a marine appearance; and it is to be considered as a transition fauna between salt and fresh water, the lake having probably been originally salt, and subsequently altered by the passage of the Jordan waters through it. Near the shore were found a small shrimp, and the crab, *Telphusa fluviatilis.* A very fine volcanic mud from the greatest depths contained diatoms, foraminifera, &c. No alga was brought up.

The Unio shells at the depth of 250 metres were curiously softened and resembled in condition the fossils of some of the Tertiary strata of the middle of France; this is probably chiefly due to pressure.

Fresh-Water Microscopic Organisms.—Prof. Maggi has published a catalogue of the Rotifera of Volconia, containing fourteen genera and eighteen species. He also gives a list of the fresh-water Rhizopoda of Lombardy, and has come to the conclusion that *Amphizonella flava* is not identical with *Pseudochlamys patella*, but that it is a developmental stage of some unknown form. He has investigated the plastids found in ciliated Infusoria, and especially those which are found in the nuclei of the Oxytricha. When these organisms are treated with a two per cent. solution of bichromate of potash, dark granulations are to be observed in the parenchyma of the body, and a black reticulum is also to be made out in the nuclei.

Zoological Notes.—The classification of the order of Discomedusæ (Discophora), of which the common Aurelia is the type, has been discussed by Haeckel in a preliminary way in the Proceedings of the Society of Medicine and Science of Jena. He divides the group into three sub-orders. He regards as the stem or ancestral genus of the order, Ephyra, a form similar to the larval Ephyra (Ephyrula) through which most of the species of the group pass. It will be seen from this that Haeckel does not regard the Trachynemidæ or the Lucernariæ as forming sub-orders of the Discophora, but independent orders. The discovery of a large number of new forms has led him to propose this new classification of the order.——Some points in the structure of the herring are discussed by Professor Moebius in the reports of the commission for the scientific exploration of the German seas, comprising figures illustrating the external and internal anatomy of this fish, and its crustaceous food, as well as the appearance of the fish at different ages; and a comparison of the herring with the spratt. He also gives a figure of a young flounder, and notes on the food of fishes and their mode of reproduction.——An elaborate work by Dr. R. Latzel, favorably noticed in *Nature*, on the Myriopods of Austria, is being issued in parts at Vienna; the first part comprises the Chilopoda; we notice that the author adopts Mr. Ryder's new order Symphyla for the synthetic form Scolopendrella.——Professor Huxley lately read a paper before the Zoölogical Society of London, on the application of the laws of evolution to the arrangement of the vertebrates and more particularly of the mammalia.——In a paper read by M. Viallanes, before the French Academy, on the sensitive nerve-termination in the skin of some insects, especially the larvæ of the common fly (Musca) and Eristalis, he finds under the hypodermis an extremely rich plexus of ganglionic cells, connected on one hand with the chief nerve-centers, and on the other with sensitive terminal nerve-branches.——In a paper read at the same meeting by M. Jourdain, on the sensorial cylinders of the internal antenna of crustaceans, he states that while these have undoubtedly the characters of an organ of sense, they cannot be those of smell. ——Mr. W. H. Ballou, in the *Chicago Field*, gives an account of the fisheries of eels in the Oswego river, New York, and a good account of the habits of the fish.——Mr. B. B. Redding of the California Fish Commission, recently read an article on the propagation of fishes before the Academy of Sciences of that State. He dwelt especially on the enormous fertility of fishes as an indication that the sources of supply of human food were only beginning to be appreciated, and that the limit of human population as set down by the Malthusians is as remote as it ever was. ——M. Bocourt of the Commission Scientifique de la Mexique, has recently investigated the structure of the scales of the Scincoid and other lizards with fish-like scales. He finds the former to be perforated by canals which divide the scales into numerous areas. The similar scales of *Tretioscincus*, *Gymnophthalmus* and allies from tropical America are homogeneous in structure.

ENTOMOLOGY.[1]

NOTES ON THE GRAPE PHYLLOXERA AND ON LAWS TO PREVENT ITS INTRODUCTION.—I have received the following letter from a well-known grape grower of St. Louis, Mo., who is largely engaged in the exportation to France and other countries of American grape-vine cuttings, and as it touches a question of deep general, even international, interest, I will make it the text for brief comment.

"* * * On page 3 of your *American Entomologist*, you urge the grape-growers of California not yet afflicted with Phylloxera to exercise 'the utmost vigilance to prevent the introduction into their own localities of infested vines or cuttings.' This last word, to me at least is unsatisfactory. Why should you support that erroneous prejudice? Is it not true that in winter, when cuttings are made and shipped, it is impossible to find a live Phylloxera on them, or any eggs of this insect? The winter-egg, if it exists at all, does not exist on one year old wood, certainly not here nor in Southern France. Ask Aimé Champin; ask Leenhardt, Robin, Planchon, even; they all looked for it in vain just as you did yourself. * * * But while Spain, Italy, Hungary work to get the prohibition of the importation of cuttings repealed, as necessary to their salvation and free from any danger of importing the destructive insect, such a word from you may frustrate their endeavors. ISIDOR BUSH."

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

The ravages of what has now come to be more generally called *the* Phylloxera, though the term should always be qualified, since there are many other species besides that which attacks the grape-vine, have attracted so much attention in foreign countries and caused so much fear in those countries not yet invaded by it, that the most stringent laws have been enacted to prevent such invasion. Some of these laws are injurious and unnecessary in so far as they prohibit the importation of all living plants, and at Cape Town, more particularly, they have been carried out with such zeal, that a cargo of potatoes arriving from New Zealand was recently destroyed for fear that the pest might be imported therein. A great deal of controversy has grown out of this stringent legislation, and Dr. Maxime Cornu has lately submitted a report, in which, while confessing that *Phylloxera vastatrix* is confined to the grape-vine and can flourish on no other plant, he yet recommends the following of the example set by Algeria, which is to forbid the introduction of all vegetable products whatever except those absolutely required for consumption.

I have been too busily engaged during the last few years with other injurious insects to give very much attention to the grape Phylloxera in this country; yet I have made continuous observations which confirm all that I have in past years written on the subject, and from which I do not hesitate to declare that it is going beyond the bounds of reason to prohibit the importation of anything more than grape vines or grape cuttings from countries or districts where the grape Phylloxera is known to occur.

The life history of this interesting insect may be thus briefly stated: Starting from a stem-mother, it multiplies agamically through an indefinite number of generations, either in galls on the leaf or in cavities or on swellings on the roots. Its spread is naturally slow in the unwinged condition, whether on the surface or beneath the ground. But winged, agamic females are produced during the late summer and autumn months, and these are the true migrants of the species and disperse and spread from vineyard to vineyard through the atmosphere. They lay some half-dozen eggs only, in such situations as afford shade and moisture, and from these come the only true males and females, which are mouthless, feed not, and are born simply to procreate, the female laying, either below or above ground, a single, and the only directly impregnated egg, which has been termed the winter egg, and which in the spring following gives birth to the stem-mother which may either found a colony in a gall on the leaf, or upon the root—the latter being the more common habit.

The prohibition of other products than grape vines is based upon the supposed possibility of winged females settling thereon and depositing the few eggs which give birth to the true males and females, which last produce the "winter egg." Now the experiments which I made in 1875 (recorded in the Transaction of the St. Louis Academy of Science, October, 1875), and which were the first recorded ot their kind, show that the eggs from the winged females are most often laid in or on the ground near the base of the vine, and that they are so delicate as to require specially favorable conditions of moisture and temperature to enable them to hatch. I do not hesitate to express my conviction that when deposited on anything else than the lower, tomentose surface of the living leaf of the grape vine, where they can receive moisture by endosmosis, or in the crevices or irregularities of earth, that receives from dew or other sources a due amount of moisture, they will infallibly perish. But even supposing that these eggs could hatch, and the resulting female should lay the impregnated egg upon any other living plant, and that this egg should in due time give birth to the stem-mother, she would inevitably perish without issue for want of appropriate food; while to suppose that all these operations could go on upon any other product or substance than living plants, or upon the dry parts of plants, is to exhibit crass ignorance of the peculiar conditions necessary to the perpetuation of the species at these particular stages. With the utmost care in endeavoring to supply the natural conditions, I have failed nine times in ten to obtain the sexual individuals, and still more frequently to get the impregnated egg, and such has been the experience of others in Europe. The danger of introducing this insect upon anything else than the grape vine, where a voyage has to be made in the tropics, is yet more remote, as even supposing the "winter egg" could be produced it would prematurely hatch on the voyage.

The only way, therefore, in which Phylloxera can be conveyed from one country to another widely separated therefrom, is upon grape vines, and here we come to the question raised by Mr. Bush. My recommendation to use certain resisting American vines as stocks on which to graft the more susceptible European vine has resulted in an immense traffic between this country and Europe in American cuttings, and nurserymen engaged in this business, however unbiased they may desire to be, naturally lean toward that side of the question which furthers their own interest. The insect may be carried on the roots of vines during the winter, either in the dormant larva state or in the "winter egg" state, and while later researches, here by myself and abroad by others, have confirmed my previous experience in this country, published five years ago, as to the rarity of the "winter egg" on the canes above ground, and the more recent observations would seem to indicate that wherever it is thus found above ground it is produced rather from the gall-inhabiting type than from the more dangerous root-inhabiting type, yet the fact that this "winter egg" does occur upon almost any part of the plant above ground, and more particularly under the loose bark of the two-year-old cane, renders it quite possible that the insect may be carried upon cuttings in this "winter egg" state, and fully justifies the prohibition of the introduction of such, as well as of rooted plants, from any country where the insect is known to occur. Indeed, considering the rarity of shipment of rooted vines, I strongly believe that the insect was originally introduced into Europe from America in the "winter egg" state upon cuttings. I would say, therefore, to those countries desirous of defending themselves from this scourge, that all danger is removed when vines and all parts of vines from infested countries are kept out. With such prohibition, all requirements are met and all legislation that goes beyond this must necessarily be hurtful to general industry; while the prohibition of traffic in American vines in countries where the grape Phylloxera is known to already occur can have no useful end and may be detrimental.

That the rarity with which the impregnated egg is found above ground greatly reduces the chances of Phylloxera introduction by cuttings is true, but in a country desiring protection from such a scourge, the remotest chance should not be risked. Mr. Bush is wrong in supposing that this egg may not occur on one year cane. I have found it upon such, and it may even occur upon the dried leaf where, in all probability, it is destined to perish.

While, therefore, I believe that the laws cannot be too stringent in preventing the introduction and use of grape vines in any living condition into a non-infected from an infected country, it is equally true that there is no danger in the mere passage through such a country of such vines or cuttings. These are necessarily boxed, and can only be safely and properly shipped during the cold or non-growing season, when the egg is dormant, so that there is a practical impossibility in the introduction of the insect by the mere passage, whether of vines or cuttings.—*C. V. Riley.*

CECROPIA COCOONS PUNCTURED BY THE HAIRY WOODPECKER.—One of the most interesting as well as difficult problems in entomology, is the relation which the cocoon sustains to the pupa, and the various ways in which the cocoon offers protection to the pupa or future imago. In particular is this true of the Lepidoptera. That cocoons to an extent equalize rapid changes of temperature and prevent the loss of moisture by the pupa, is beyond a doubt. But that they offer protection against other natural destructive agencies, such as mice and birds, is, in the case of the latter, to a certain extent untrue. There is at least one bird, the hairy woodpecker (*Picus villosus* Linn.), from whose beak the staunch cocoon of the Cecropia offer no protection whatever.

In the early part of the winter of 1879–80, I noticed one of these birds clinging to a twig, pecking away at the parchment-like covering of a cocoon attached thereto, in a manner that amused me very much, and I was hugely enjoying its (as I supposed) vain attempts to penetrate it. But when it hopped to an adjoining limb, shook itself and performed in a manner which years of observation had taught me was not indicative of a hungry bird, I began to think its powers had been vastly underestimated. By the aid of a ladder the cocoon was obtained and found not only to have been punctured, but all the soft and liquid parts extracted. As there were others attached to the same tree which upon examination proved to be uninjured, I was led to believe the bird had found a weak part.

After a few days these were examined and another found to be punctured, this time fairly upon the crown and apparently in the strongest part. I now saw what had before escaped my notice, viz: that by the situation of the first cocoon it was accessible to the bird only from below, which accounted for the puncture being near its base, close to the twig. A short time afterward, on passing another tree, out from among the branches flew the little murderer, and, as usual, a punctured cocoon was found, the puncture yet wet with the juices of the pupa, showing that I had surprised the bird while at breakfast.[1]

Afterward an examination of over twenty cocoons, found in a small grove of *Negundo aceroides*, showed only two uninjured.

That the birds were not in quest of parasites is at once evident, as a parasitized larva of one of these moths reaches only the first stages of the pupa state, as the many cocoons I have examined contained only the dried skins, in nearly all cases, of larvæ apparently having expired immediately after having constructed their cocoons, leaving at this season nothing containing any liquid matter whatever, and nothing to afford nourishment for birds.

A year has gone by, and at this date (January) the little destroyers are at work, and I can easily distinguish the dry rattling sound, the death knell of the beautiful moth, the larva of which seems to be as destructive to vegetation as the imago is innocent. So far as I have been able to observe, the birds do not attack these cocoons (a number of which accompany this paper) until winter, when other insect food is not so easily obtainable. In fact, this seems to be a source of subsistence stored up for this season of the year, always fresh and, to all appearances, at all times available.—*F. M. Webster, Waterman, Ills.*

NOTES ON THE ELM-TREE LEAF-BEETLE (GALERUCA XANTHOMELÆNA).—Perhaps the following may in part answer some of Dr. LeConte's inquiries about the imported elm leaf-beetle. My first acquaintance with the insect was in October, 1877. My friend, Mr. H. L. Otterson, a farmer, of Cream ridge, New Jersey, drew my attention to a strange foray of "squash bugs" (as he called them) in the garret. They swarmed in every hiding-place, seeming to take special delight in the old clothes and certain rolls of

[1] This cocoon was opened nearly two months afterwards at the Bloomington meeting of the Illinois State Nat. Hist. Society, and the pupa found to be still alive.

woolen remnants. He stated that they had appeared in great numbers the previous summer on the large elm shade tree near the house, and that the tree, at the end of the summer, looked as if its leaves were nearly gone, but he did not examine the leaves; "and now," said he, "the pests have taken possession of the house." I pointed out to him that though to the popular eye they did look like squash beetles (*Diabrotica vittata* Fabr.), they were a different affair; but that they would do no injury to the house other than by being an annoyance, as next spring they would doubtless, if allowed to, get out of their dwelling and into the the trees again.

I have followed up the career of this Galeruca as well as I could. Upon this particular farm, which had three elms on it, the history is briefly this: They appeared about the first of May, 1877, suddenly and in great numbers. They hibernated in the garret three winters, getting out of the house in May following each winter. In trying to get out of the house in May, 1880, they swarmed on the inside of the windows, and large numbers were destroyed by brushing them into a pan of scalding water. Their depredations on the three trees were through four summers. The leaves would be eaten off, and a new sickly crop follow early in the fall. My friend is afraid that the trees cannot recover. He did not observe the "worms." The beetles have not been found in the house this last fall or present winter, and they were not so numerous on the trees last summer.

In May, 1879, one of our students at New Brunswick, N. J., brought me several specimens of *G. xanthomelæna*, which he caught on the curtains of the parlor windows. They were trying to get out of the house, having hibernated there. The house is in the city and has elm shade trees. The same youth directed my attention to the fact that these insects were in quantities in the gymnasium loft of Rutgers' College Grammar School, and there they had hibernated two winters. The shade trees are elms. They have been three years in New Brunswick. The first time they appeared suddenly and in quantity, and their depredations set the citizens to work scraping and cleaning the bark. The second year they came in less numbers, and still less the third year.

These observations simply cover the following points: 1. Their first appearance is sudden and in numbers. 2. Either the imago or larvæ or both are voracious leaf eaters of the elm. 3. The imago hibernates; and 4, it has a penchant for the protection of buildings. 5. Judging from the freshness of all the specimens I have seen, I should think the beetles were but just evolved from their pupæ when they seek their winter quarters. If this be so, their life cycle is a rapid one, the egg in May and the imago in early autumn. But this must be determined by actual experiment.

I have queried whether their great numbers at the first observed appearance may not be due to the almost entire absence of natural enemies, and their subsequent decrease to the presence of the same.—*Samuel Lockwood, Freehold, N. J.*

[The development is far more rapid than our correspondent supposes. There are at least three generations at Washington, and doubtless more than one in New Jersey.—ED.]

FOOD HABITS OF SAPERDA CRETATA.—In your recent valuable article on the food-plants of *Cerambycidæ* I notice that no mention is made of *Saperda cretata.*. This beautiful species, an account of which I published in the *Western Stock Journal and Farmer* (Dec. No., 1880), has been been taken from the branches of apple trees and specimens of both the insect and its work sent me by Mr. C. G. Patten, of Charles City, Ia.

The eggs are evidently laid in pairs, half an inch or more apart along the branch, the larvæ of each pair upon hatching, working in opposite directions around the branch, at first just beneath the bark, but afterward (probably after the first year), entering the hard wood.—*Herbert Osborn, Ames, Iowa.*

HYBERNATION OF THE COTTON WORM MOTH: EASE WITH WHICH MISTAKES ARE MADE.—Mr. I. A. Wimbish, of Cuero, DeWitt Co., Texas, writes as follows:

I enclose you one of several moths (*Aletia argillacea*) captured on the evening of the 4th of December (thermometer 62° F., wind S.E.), whilst flying around the lamp in my bed-room. For some weeks previous the temperature had varied from 22° to 48°, the prevailing winds having been N. and N.E. Such a low degree of temperature is unusual in our locality; and rarely occurs more than once during an entire winter.

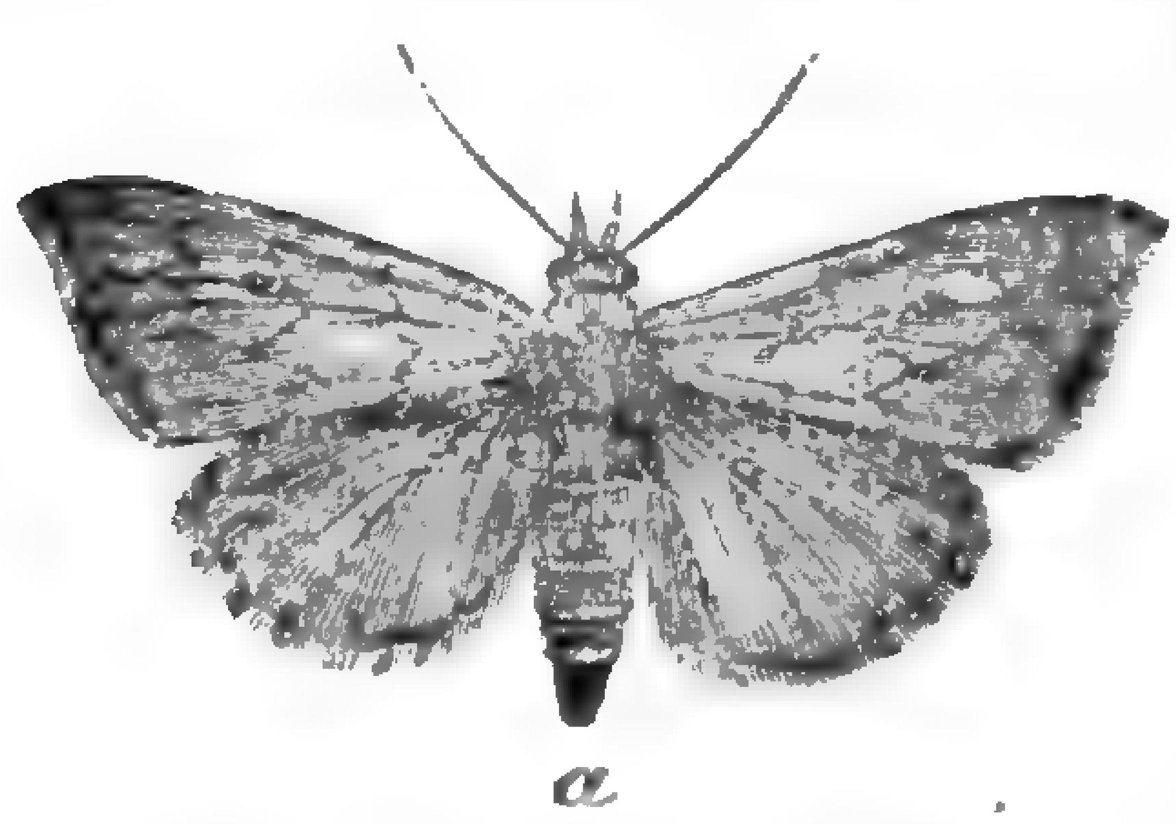

FIG. 1.—*Aletia argillacea.*

The presence of this moth, at this time, I regard as very good evidence of the truth of the hibernating theory. If this pest can survive such weather as we have already had, the probability is, that there will be no further danger during the remainder of the winter.

Before closing this note, I will take occasion to remark that I have been a resident of this county since 1851, and have planted twenty-eight crops of cotton. Of this number, I have never raised a crop, until the present year, which was not more or less injured by the worm, the damage varying from thirty to seventy-five per cent.

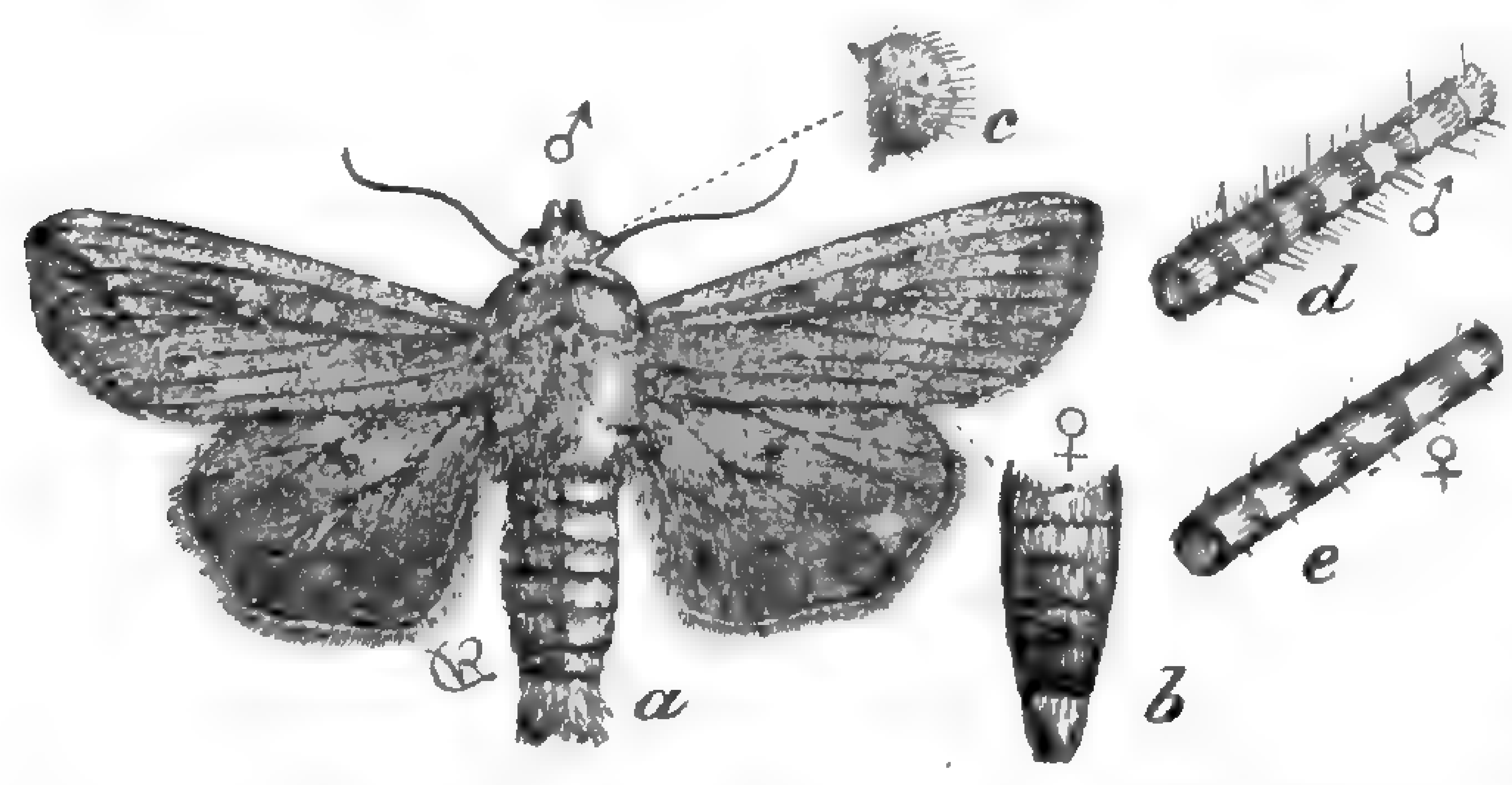

FIG. 2.—*Leucania unipuncta; a*, male moth; *b*. female abdomen, natural size; *c*, eye; *e*, portion of female antenna; *d*, do. male (after Riley).

This year, 1880, from the liberal use of London purple—thanks to your investigation and suggestion — the damage has been scarcely appreciable, the fields remaining perfectly green and fruiting until frost, Nov. 5th and 6th, and are now still white with unpicked cotton.

The specimen sent by Mr. Wimbish was so badly rubbed and broken that it would have been past recognition by any one not thoroughly familiar with the cotton-worm moth, and the other species so apt to be mistaken for it. Yet correct determination is most essential in all such questions and by the ovipositor alone we recognized the specimen as that of the common army-worm *(Leucania unipuncta)*. For the benefit of the general reader, and especially of our Southern friends, who are most deeply interested in the question, we give herewith illustrations of both these moths. The ovipositor of the female Aletia is a simple, slightly extensile, cylindrical tube, while that of the Leucania, as shown in Fig. 3, is a compressed, narrow, blade-like, horny process, easily recognizable when all other characters of the species are obliterated. We may say, *en passant*, that on account of the general similarity of color and the frequency with which it occurs in the Southern States during winter time, this Leucania is the most liable to be mistaken for the Aletia.

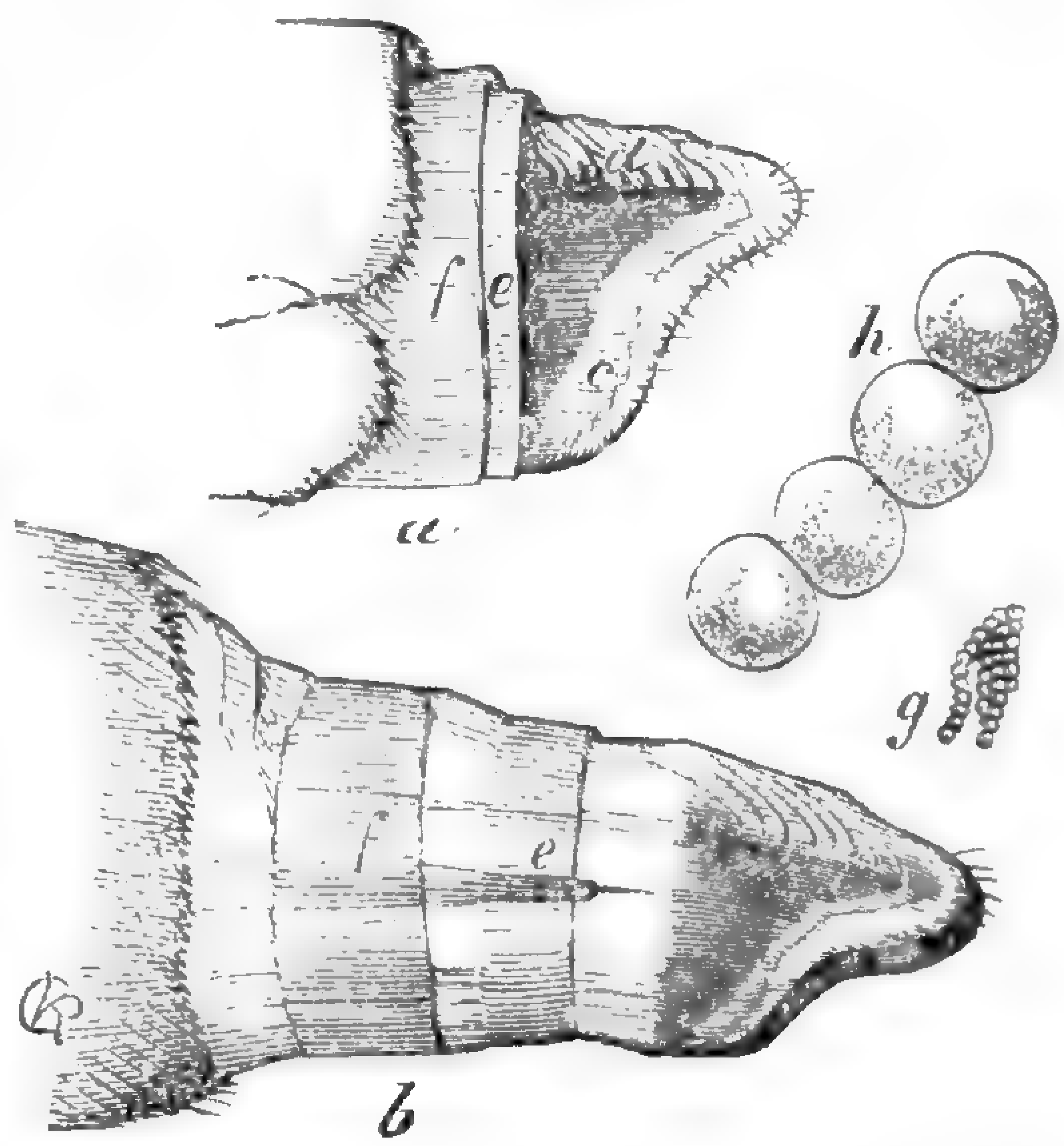

FIG. 3.—Army-worm moth; *a*, end of abdomen denuded and showing ovipositor at rest; *b*, same with ovipositor fully extended; *e*, *f*, retractile subjoints; *h*, eggs—all enlarged; *g*, eggs, natural size (after Riley).

PYRETHRUM SEED.—I have obtained direct from Europe some seed of *Pyrethrum roseum* for distribution among the agents of the U. S. Entomological Commission, with a view of introducing this valuable plant in various portions of the country where it may be acclimated. I have a small quantity to spare to such of the readers of the NATURALIST as will agree to carefully sow the seed and cultivate the plants and report to me the results of the attempt. I should like to send it especially to those residing in the mountainous or more elevated regions of the South as well as in Colorado and about Lake Superior, and will send to such upon application.—*C. V. Riley.*

ANTHROPOLOGY.[1]

ANTHROPOLOGY IN MISSOURI.—The Academy of Science of St. Louis published two important additions to anthropology during the past year: "Contributions to the archæology of Missouri, by the Archæological Section of the St. Louis Academy of Science. Part 1, Pottery, by W. B. Potter and E. Evers. Naturalists' Bureau, Salem, Mass., 1880, 30 pp., 24 lith. pl., 5 maps, 4to;" and

[1] Edited by Prof. OTIS T. MASON, Columbian College, Washington, D. C.

two papers in Vol. IV, No. I, of Transactions, entitled, "The Geological and Geographical Distribution of the Human Race," by the Hon. Nathaniel Holmes, and "Zoque, the language spoken at Santa Maria de Chemalapa, and at San Miguel and Terra Blanca, in the State of Chiapas, Mexico," by Antonio de Coruna y Colludo, translated by J. A. Dacus.

The memory of pleasant days passed with our friends during the meeting of the American Association in 1878, and of the valuable collections which they have made at great expense, is reawakened by the appearance of these two volumes. The paper of Judge Holmes is in the nature of a lecture upon the origin and early migrations of our race. Starting out with Mr. Wallace's six zoölogical provinces; Palæarctic, Oriental, Australian, African, Nearctic, and Neotropical, it is assumed, "that man's distribution over the earth must have pursued an analogous course, under the threefold operation of evolution, migration over continuous areas, and extinction in some areas." The author considers it scientifically demonstrated that man existed in Europe in the Miocene period. After passing in review the Canstadt, Cromagnon and Furfooz races of western Europe, Judge Holmes turns aside to combat Professor Dawkins' theories concerning the post-tertiary origin of man and the identity of the Eskimo with the cave-dwellers of Dordogne.

As to our own country, it is held that the earliest existence of our race, was in the Pliocene of the Pacific coast, and that they progressed to the Atlantic border when the land communication was established across the continent. The subject of bands of color coördinated with other racial characteristics, of the pristine home and the migrations of men, the causes of racial differences, the peopling of America, and of plurality of origins are thoughtfully considered.

The Zoques were once a powerful nation, extending from Tehuantepec through Tabasco and Chiapas into Oaxaca, now numbering from 2500 to 3000. At present they are confined to a small district and two mean villages, Santa Maria de Chemalapa and San Miguel. Their language belongs to the Maya-Quiche, most nearly related to the Tzendal-Maya. Three pages of vocabulary accompany the paper on the Zoques.

The work of Professor Potter and Dr. Evers is destined to become a classic upon the archæology of Southwestern Missouri. We have in their monograph a neat quarto resembling very much in outward appearance the Smithsonian separate Contributions to Knowledge, and containing: 1. A paper on the archæological remains in south-western Missouri, by Professor W. B. Potter, which is a model of brevity and precision (pages 5–19); 2. A paper on the ancient pottery of south-eastern Missouri, by Dr. Edward Evers, which is exceedingly cautious as to its theories (pages 21–30); 3. At the close of the text are five maps to illustrate Professor Potter's paper, and twenty-four lithographic plates containing one hundred and forty-nine figures drawn to a scale by Dr. G. Hambach, to illustrate Dr. Evers' paper. Excepting a few faults of proof-reading, the press-work and illustrations are all that could be desired.

One must study this volume with a good map of Missouri before him. The geology of the south-eastern corner of the State is well described, especially the ridges bounded by bayous upon which the remains are located. Two ridges are included within the present survey: the "Sandy Wood Settlement," near the town of Diehlstadt, in Scott county; and the "New Madrid and Sikeston Ridge," in New Madrid county. The latter ridge furnishes four settlements besides several scattering mound sites. The especial characteristics of these village sites are an earth wall and ditch enclosing a given area, an oblong principal mound, around which is an elliptical clear space, innumerable lodge-hollows filling the remainder of the enclosure beyond the clear space, and, finally, here and there, burial mounds, from which hundreds of skeletons and many thousands of specimens have been exhumed.

It is very difficult to abridge Professor Potter's terse description, and we regret the want of space to give even his summary (pages 17–19).

In Dr. Evers' portion of the volume will be found descriptions of the materials, shapes, coloring and decorations of the pottery.

The material is a dark, grayish clay, mixed with sand and shells, and sun-dried. (On the last point, see Professor Putnam's excellent review of this work in the *Sc. Am. Supplement,* Jan 1, 1881, 4161–4163.) The color is generally black, and, in some specimens, moulded in the clay. The decorations are red, white and black, not burned in.

In shape the vessels are classed as long-necked; short-necked; wide-mouthed, shallow dishes, with or without handles; gourd-shaped; animal-shaped; and those exhibiting the human form. A few forms are suggestive of Peruvian, Central American, Pueblo, cliff-dwelling, and even Asiatic pottery; but Dr. Evers as well as Professor Putnam have evidently learned caution through a large experience. The greatest variety in supporting the vessels is exhibited in Dr. Hambach's drawings.

The ornamentations are either moulded in the vessel, luted on the surface, incised, or painted on the outer surface (very rarely on the inside). The author makes an observation with reference to the design of these varied forms of embellishment which strikes us very favorably indeed. It might be called "the law of the least marvelous." He contends that ancient implements must not be referred to any function more important or significant than a corresponding one of the present day.

In conclusion, the NATURALIST extends its congratulations to the St. Louis Academy of Science upon the prosecution of an investigation so thorough that it will never need to be repeated.

THE STUDY OF INDIAN LANGUAGES.—Major J. W. Powell has just issued a second edition of "Introduction to the Study of Indian Languages, with phrases and sentences to be collected. Washington, 1880." Although purporting to relate to language alone, the work covers the whole ground of anthropological research. Chapter I is a discussion of the alphabet, together with the best method of transliterating an Indian language. Chapter II is headed Hints and Explanations, and is a preparation for the lists of phrases and sentences to be collected in the schedules. These are divided into thirty-two sections, treating of persons, parts of the body, dress and ornaments, dwellings, implements and utensils, food, colors, numerals, measures, divisions of time, standards of value, animals, plants, geographic terms, geographic names, the firmament and meteorologic phenomena, kinship, social organization, government, religion, mortuary customs, medicine, amusements, new words, accidence, pronouns and transitive verbs, possession, intransitive verbs and the other parts of speech used as verbs, voice and mood and tense, the best method of studying materials collected, the rank of Indian languages. Chapter III is a collection of schedules containing a great variety of questions in order to bring out the truth with reference to each of the subjects named above.

In the back of the volume is a set of kinship charts which embrace both consanguinity and affinity for nine generations, including that of *ego*, four above *ego*, and four below *ego*. Instead of using the old-fashioned circles for the individuals in the group, found in Mr. Morgan's tables and elsewhere, the triangular characters used by the Indians themselves to denote man and woman are worked up with a series of colors so as to present to the eye at a single view, all the facts desired.

The alphabet presents a few innovations, which are usually very undesirable, but which in this case are on the whole an improvement, since they substitute a plain letter, which may be found in any printing office, for characters and logographs difficult to reproduce.

A PRE-HISTORIC ROCK RETREAT—In January, 1876, the late S. S. Haldeman, Professor of comparative philology at the University of Philadelphia, discovered on his farm near Chickies, Pa., upon the eastern bank of the Susquehanna river, a rock retreat of the prehistoric age, which yielded him, when he explored it with the spade, a large number of stone implements, and proved to be a locality where the occupation of arrow-making had been followed for a long lapse of time. This retreat, located in Lancaster Co., had been made the subject of several printed communications by Professor Haldeman, the last of which was the one read before the American Philosophical

Society of Philadelphia, Pa., June 21, 1878, and printed since in the Transactions, Vol. xv, page 351–368, with fifteen lithographic plates; one of these represents the rock recess with the railroad track running in front of it. The text accompanying the plates contains a statement concerning the probable age of the relics; thirty inches of black mold accumulated by decaying vegetation would seem to indicate to the author a time roughly estimated at two thousand years. The objects found are described under the following headings: Knives, chisels, scrapers, borers, arrow-heads, spear-heads, hoes and diggers, sinkers, hammer-stones, tomahawks of honor, pipes, cores and chips, pebbles, shells, bones, pottery; the latter showing a large number of different patterns. The professor's remark (page 354), that the name "celts", given to the stone chisels, should be restricted to the people who bear this name, is not quite to the point, for this term, in Greek, χέλτης, stands in no connection whatever with the national name of the Celts; but is related to the Latin verb *cælare*, to chisel out, to engrave; and to the substantives: *cælatura*, the art of chiseling and that of making relievos; *cælamen*, a basso or mezzo-relievo; *celum*, the artist's chisel.

Antiquity of Man.—In the *Princeton Review* for Nov., Principal Dawson reviews Dawkins on early man in Britain, Barrande's "Brachiopodes," "Les Enchainements du Monde Animal," by Gaudry, and Saporta's "Le Monde des Plantes," in their relation to the antiquity of man and the origin of species. Objecting to Professor Dawkins' classification of the later tertiary, the writer suggests the following: I. Pleistocene, including *(a)* Early Pleistocene and *(b)* Later Pleistocene; II. Modern, or period of man and modern mammals, including *(a)* post-glacial and *(b)* recent. Exception is also taken with good reason to Dawkins' separation of the cave men from the river-drift men, and to his identification of his cave men with the Eskimo. On the next page, however, Dr. Dawson is not so hard to please, when he says that the connection of the Etruscans with the introduction of the bronze age into Central Europe, viewed in relation to their probable ethnic affinities with the neolithic and Iberian races, remarkably welds together the stone and the bronze age in Europe, and explains their intermixture and "overlap" in the earlier lake habitations of Switzerland and elsewhere. The portion of the paper germane to our notes closes with an endeavor to recall the historical deluge as a force in the production of those physical changes which separate the deposits containing the remains of palæocosmic man from those of later date. The paper appears in full in the *Kansas City Review*, for January and February.

The Aztec Dictionary of Father Aolnzo de Molina is a most important help for the study of the Aztec or Mexican language, and since it gives the ancient, uncorrupted forms of this sonorous tongue from a time dating but little after the conquest, it is highly appreciated by all Mexicologists. The number of Aztec terms contained in each of the two parts, Spanish-Aztec and Aztec-Spanish, cannot fall much short of thirty thousand. The great scarcity of both editions (1565 and 1571) has raised its price rather high, but through Platzmann's recent re-publication of the second edition linguists are now enabled to acquire this "Thesaurus" at a very moderate figure. The new edition reproduces the work in *fac-simile* and bears the following title: "Vocabulario de la Lengua Mexicana, compuesto por el P. Fr. Alonso de Molina, Publicado de nuevo por Julio Platzmann, Leipzig, B. G. Teubner, 1880, Quarto." The volume is dedicated to the memory of the Empress Catharine II., of Russia, the first sovereign who encouraged linguistic researches within the limits of her vast domains in Europe and Northern Asia.

THE INDO-CHINESE AND OCEANIC RACES.—Mr. A. H. Keene, of whose work the NATURALIST has frequently made mention, commences in the number of *Nature* for Dec. 30, a series of papers on the Indo-Chinese and Oceanic Races—types and affinities. The following scheme will be followed in the discussion:

A. DARK TYPES.

I. NEGRITOS: Aetas; Andamanese; Samangs; Kalangs; Karons.

II. PAPÛANS:
- Central branch—Papûans proper.
- Western branch—Sub-Papûans, West (Alfuros).
- Eastern branch—Sub-Papûans, East (Melanesians).

III. AUSTRAL: Australians, Tasmanians?

B. CAUCASIAN TYPE (Fair and Brown).

IV. CONTINENTAL BRANCH: Khmêr or Cambojan Group.

V. OCEANIC BRANCH: Indonesian and Sawaiori or Eastern Polynesian Groups.

C. MONGOLIAN TYPE (Yellow and Olive Brown).

VI. CONTINENTAL BRANCH: Indo-Chinese Group.

VII. OCEANIC BRANCH: Malayan Groups.

THE PAWNEE INDIANS.—Mr. John B. Dunbar, of Deposit, New York, contributes to the November number of the *Magazine of American History* a paper of twenty-four pages upon the Pawnee Indians, describing their trade, food, feasts, hunting, war and medicine. The list of food plants and the discussion of the practice of medicine are especially good. It has been asserted in very high quarters that the Indian of this continent had primarily no knowledge of the medicinal properties of herbs aside from incantation. It might be well for Mr. Dunbar to give this question a little attention. Sooner or later some scholar or group of scholars will publish an encyclopædia of our Indian tribes, and for this work such monographs as the one under consideration are a necessary preparation.

THE WESTERN RESERVE SOCIETY.—From our esteemed correspondent, Col. Charles Whittlesey, we have received a tract entitled "The Universal Indian Problem," and No. 50 of the pamphlets of the Western Reserve & No. Ohio Hist. Soc., containing the Indian narrative of Judge Hugh Welch, and Wyandotte missions in 1806 and 1857, both edited by Mr. C. C. Baldwin. The former is a letter to General Garfield on the subject of Indian education, which takes a rather gloomy view of the subject. Of the latter, as well as of all the publications of this society, we take great pleasure in saying that the permanent records of an association can be valuable in the highest degree without being in the least costly or pretentious.

The Census of Alaska.—The *New York Herald* for January 10 and 11, gives a detailed account of the exploration of the Alaskan peninsula for the purpose of enumerating the population, and of studying the habits of the natives. No one better fitted for this service could have been found than Mr. Petroff, who adds to his thorough knowledge of the Russian and English, a practical acquaintance with ethnology, acquired while assisting Mr. Bancroft in the preparation of his great work on the native races of the Pacific States. Mr. Petroff will prepare an elaborate paper on Alaska for the next census and will contribute a memoir to the volumes of the Ethnological Bureau.

The Davenport Academy, Iowa.—The Davenport *Daily Gazette* for January 6, 1881, contains the record of the annual meeting of this thriving society. The retiring president, Mr. Pratt, devoted the annual address to the discussion of the mound-builders. Mr. J. Duncan Putnam was elected president for the ensuing year, and Dr. C. C. Parry, corresponding secretary. Notice is given that the printing of volume III will be resumed at once.

GEOLOGY AND PALÆONTOLOGY

Apparent Glacial Deposits in Valley Drift.—While collecting facts regarding the question whether there was in Maine a re-advance of the glacier subsequent to the deposition of the sedimentary Champlain clays and valley drift, the writer observed certain large boulders lying on or in the valley drift which seemed too large to have been deposited by any of the ordinary forces of valley transportation. Sometimes numbers of boulders were found in pell-mell masses quite morainal in appearance, and I was for a time inclined to regard them as glacial. The smaller stones and boulders might readily be supposed to have been carried down in spring by floating blocks of ice, but the largest of them staggered me, until one day I found a boulder weighing not far from one hundred tons lying on the undisturbed silt of the present flood plain of the Piscataquis river. Its history was as follows: Ever since the first settlement of the country that rock had stood right in mid-channel, a constant object of apprehension and vituperation to the lumbermen, for many were the "jams" of logs which it had caused, some of them of large size. But nothing moved it perceptibly until a few years ago, when, during a mid-winter flood, a great ice gorge formed against it and a very high dam soon extended to a considerable distance on each side of the river. When, at last, the ice rushed downwards with irresistible force it wrenched the offending rock from its bed in the till, pushed it up a steep bank twelve feet high, and left it two hundred feet back from the river, together with large piles of stones and boulders. The flood plain, being frozen, suffered but little erosion. Many similar facts have since been observed. Evidently if blocks of granite ten or more feet in diameter can be tossed about like this, then in the case of narrowish valleys subject to floods and ice gorges, the presence in the valley drift of erratics and masses resembling moraines is to be received with great caution as a proof of glacial conditions, unless the deposits are very abundant and continuous, or are supplemented by striæ or other positive indications. So also the development of the aasar or kames seems to show the frequency and great transportive power of ice gorges in the channels of the glacial rivers. During the decadence of the great glacier, transportation of this kind would probably be active all along the line of the terminal moraine, more particularly in the valleys of those streams whose head-waters were in the region covered by the ice, such, for instance, as the valleys of the Delaware, Susquehanna and Allegheny. At least they deserve careful investigation for such deposits.—*George H. Stone, Kent's Hill, Maine.*

EXTINCT PALÆOZOIC FISHES FROM CANADA.—At a recent meeting of the Natural History Society of Montreal, Mr. Whiteaves read a paper on "Some new and remarkable fossil fishes from the Devonian rocks of the northern side of the Baie des Chaleurs." He commenced by remarking that until last year a long strip of the northern side of the bay had been mapped as belonging to the conglomerates of the Bonaventure formation, which form the base of the Carboniferous system. Last year, however, Mr. R. W. Ells, of the Geological survey, discovered a fine specimen of a fossil fish belonging to the genus *Pterichthys*, of Agassiz, in Escuminac bay, a discovery which led to a careful re-examination of the locality by Messrs. R. W. Ells, T. C. Weston, and A. H. Foord. From the researches of these gentlemen, we now know that at this point Devonian rocks crop out from under the Bonaventure conglomerates, and further, that these Devonian rocks hold a rich and extremely interesting series of fossil plants and fishes. The vegetable organisms will be described by Principal Dawson at some future time, but the fossil fishes, of which many specimens were exhibited at the meeting, were shown to belong to the following genera and species:—1. *Pterichthys.* A fine species, supposed to be new, which has been described in the August number of the *American Journal of Science* as *Pterichthys canadensis.* 2. *Diplacanthus;* a cluster of fin rays only, of a small form, possibly referable to this genus. 3. *Cheirolepis*. A beautifully preserved fossil fish, about a foot in length, which cannot at present be distinguished from the *Cheirolepis cumingiæ* of Agassiz, which was so named in honor of Lady Gordon Cuming, of Altyre. 4. *Phaneropleuron*, nov. sp. 5. *Tristichoporus*, nov. sp. 6. Portion of the vertebral column of the above species of *Tristichoporus* shewing the neural and hæmal spines and the processes which support the rays of the tail, also the two ischiatic bones with the metatarsals attached, which must have formed the bases of two enormously developed ventral fins.

THE MILLSTONE GRIT IN ENGLAND AND PENNSYLVANIA.—In the February number of the *Amer. Journ. Science*, Mr. Chance, of the Geological Survey of Pennsylvania, calls attention to the remarkable parallelism between the stratification of the Millstone grit in Pennsylvania and England. He gives the following comparative sectional tables from the reports of the two countries:

Yorkshire.	*Pennsylvania.*
Rough rock.	Homewood sandstone.
Shales (sporadic coals).	Mercer coal group.
Second grit.	Conoquenessing Upper sandstone.
Shales (coal).	Quakertown coal.
Third grit.	Conoquenessing Lower sandstone.
Shales (coal).	Sharon coal.
"Kinder Scout" grit.	Sharon or Ohio Conglomerate.

Over large areas this nomenclature is applicable to all vertical sections in both Yorkshire and Western Pennsylvania. The top and bottom sandstones are especially durable and constant, and form "key rocks" in both countries, for the determination of other horizons.

A NEW FOSSIL BIRD.—The Amyzon Shales of the South Park of Colorado have furnished many fine specimens of insects, fishes and leaves, and a very fine bird, with feathers well represented. The latter was described by Mr. J. A. Allen as a finch, under the name of *Palæospiza bella*. It is interesting to learn that another bird has been procured from the same bed. The specimen includes the posterior half of the body including the hind legs. The tail feathers are preserved in place. The characters are those of a wading bird, and Professor Cope describes it in the current number of the Bulletin of the U. S. Geological Survey of the Territories, of Dr. Hayden, under the name of *Charadrius sheppardianus*. It is dedicated to the zoölogical artist, Edwin Sheppard of Philadelphia.

THE STREAM-TIN DEPOSITS OF BLITONG.—Dr. Martin of Leyden has determined the age of the Stream-tin deposits of Blitong (or Biliton), by means of an extensive series of *Mollusca* obtained from it. They number sixty-one species, of which only two are certainly new to science. The remainder are all recent species, excepting a *Cerithium*, which has hitherto been only known from the strata of Mount Sela in Java. *Prionastræa tesserifera* Ehrbg. exists at present only in the Red sea, but the remaining species are found in the sea of Blitong. The strata are determined to be posttertiary.

Geological News.—Professor Marsh shows that the neural cavity of the sacrum in *Hypsirhophus (Stegosaurus) ungulatus* is ten times the size of the brain case of the skull of the same animal.——In the Acts of the Tuscan Academy of Sciences for November, 1880, M. De Stefani publishes a systematic table of the geological formations of the Apuan Alps. The principal formations are the Eocene, the Lias and the Trias.——The following statistics of the output of crude fertilizers from the beds of Beaufort and Charleston, South Carolina, is furnished by Mr. E. Willis: 1875, 122,790 tons; 1876, 132,626 tons; 1877, 163,220 tons; 1878, 210,328 tons; 1879, 199,566 tons; 1880, 190,763 tons; 1881 to Feb. 1st, 173,168 tons.——The United States Geological Survey of the Territories under Dr. Hayden, in closing its work, has just issued three geological maps of the adjacent parts of Wyoming, Utah, Idaho and Montana. They represent the regions of Bear lake, the water shed of the Snake and Green rivers, and the Yellowstone Lake region. They are beautifully executed.

GEOGRAPHY AND TRAVELS.[1]

Franz-Josef Land Revisited.—The Arctic explorer, Mr. B. Leigh Smith, sailed in the steam yacht *Eira* from Peterhead, Scotland, on the 19th of June, 1880, on a voyage of discovery. We condense from reports in the London *Times* and *Illustrated London News* the following account of his very successful trip.

The *Eira* is a steam vessel of three hundred and fifty tons gross, measuring one hundred and thirty-five feet in length by twenty-five feet of beam and carried a crew of twenty-five all told.

The island of Jan Mayen was reached about June 29th, and was found almost encircled with ice. Sailing along the edge of the main pack they endeavored to reach the east coast of Greenland, near Cape Bismarck, the farthest point reached by the Germans. On the 2d and 3d of July, they got among the bladder-nosed seals and shot over three hundred of these animals. They worked in towards the west until the 9th in 75° 40′ latitude; but the weather was foggy, and all the time the ice was getting closer and heavier, some of the floes met with being very large. On the 9th nothing could be seen from the crow's nest but ice closely packed, and the idea of going further west had to be given up. It was very discouraging to have to work their way back again; but it had to be done. They reached the open sea again on the 11th.

They steered northward again on the 13th, and on the 16th

[1] Edited by Ellis H. Yarnall, Philadelphia.

they came upon block ice in 75° 50′ latitude and about 5° east longitude, and had to go eastwards towards Cloven Point—a well-known landmark to the north-west of Spitzbergen. Passing that point they anchored to a floe of land ice off Welcome Point on the 18th. The intention at this point was to steer north; but after more battling with the ice they had again to bout ship and make the best of their way to the open sea. It is mentioned as an unusual circumstance that the islands known as the Norways and Fair Haven were closed with ice. They anchored at the head of Smeerenburg Bay and took in water on the 20th; and, having sailed at once, were taken in a strong gale and had to seek shelter in Magdalen Bay. They lay there three days. The gale over, they sailed southward, and cleared the South Cape of Spitzbergen at midnight on the 30th of July, and next day came upon loose floating ice, which, as they advanced, got much closer; and about 9 P. M., when within twenty-four miles of Hope Island, they had to take a south-westerly course to get clear of the ice. They reached a point 76° latitude and 25° longitude, and wanted to work northward after rounding the ice towards Wiches or King Charles Land, but finding this impossible, they took a north-easterly course with the idea of getting to Franz-Josef Land. They reached the pack ice on the 6th of August in 77° 14′ lat., and the course had again to be changed. Thence they continued in a north-easterly course, leaving the ice to the west, until the 8th, when they reached 79° 4′ lat. and 45° 38′ east long., and met with ice again. From this point they took a northerly course, and encountered very misty weather. On August 10 they reached 79° 40′ lat. and about 46° 50′ east long.—the farthest north point yet reached in this direction. Nothing could be seen but ice in very large and heavy floes, although it was expected that land would have been in sight. They returned in the afternoon with the intention of making for Franz-Joseph Land, and after getting clear on the 11th were caught in a strong gale and driven south as far as 78° 17′ lat., and 46° 19′ east long. From this point they steamed right up, and on the 14th, at 8 A. M., they sighted the land. In the afternoon they anchored to a land floe, attached to an island off the mainland—some one and a half miles long. Here they found large numbers of walruses, and that evening the party shot no fewer than seventeen of them.

Next day they had to shift on account of the drifting of the ice, and in the afternoon anchored to a floe some two miles long at a distance of ten miles from the land. Far "inland" they found an enormous tree with branches and roots apparently complete as it had been torn out of the ground. It is a common thing to find driftwood in these regions, but an entire tree is a rare sight. It is likely that the tree was a Siberian larch, and that it had been washed down by some of the Siberian rivers. On the 16th they came upon another island, on which they landed, and erected a staff on a cairn, in the center of which they left a record. On these islands a number of curious specimens were found. The last Dutch expedition sighted land westward of this, and called it Barents Hook. This point was also seen by Mr. Smith, and the *Eira* was steered towards the land. They passed the point close to the land in foggy weather. Early one morning they landed on the island some twenty miles from the easternmost point, and found luxuriant vegetation. While off this island they sounded and found the average depth to be from fifteen to twenty fathoms about a mile off the coast.

Very large icebergs were seen quite unlike those met with in Baffin's Bay. The Franz-Josef Land iceberg is a vast mass from one hundred and fifty feet to two hundred and fifty feet high and of great extent, with a perfectly level top. Breaking off from the glaciers which line the coast, these do not float southwards, and the direction of their drift is one of the problems which are waiting for solution.

The new country was forbidding enough. It was covered with a glacier extending down to the sea. Even the off-lying islands had their caps, and the land was only visible at long intervals, in black precipitous masses, rising up between the icy expanses; yet animal life was abundant. Two right whales were seen; there were great numbers of walrus and seals, and the ivory gulls were breeding on one of the islands.

At noon on the 18th they discovered a new harbor, which they had no hesitation in naming Eira Harbor, after their vessel. It is formed by two islands, and affords good anchorage of from five to seven fathoms. It is well sheltered from all sides. It lies in 80° 5′ 25″ north latitude, and about 48° 50′ east longitude.

Here the lofty cliffs formed a vast amphitheater, and below there was a flat plain where many hyperborean plants were growing. But the surrounding scenery was wild and desolate in the extreme. Nearly the whole coast was occupied by glacier after glacier rolling down to the sea, with black headlands abruptly rising through the ice at long intervals. The great size of the icebergs and the extent of glacier are indications that Franz-Josef Land is of vast extent.

This harbor was made a rendezvous, from which, the next few days, numerous trips were made up the numerous fjords which pierce the mainland to the north and north-west. From the point named by the Dutch, Barents Hook, they traced the land westward some 110 miles, and from the extreme north-west point reached sighted land 40 miles further to the north-west. They found that this land was divided from the newly-discovered islands by a sound, which seems to be an extension of Markham's Sound. Lying in this hitherto unexplored tract of sea they discovered seven small islands, each measuring four to five miles long, and four larger islands—these latter being in the vicinity of Eira Harbor

—the largest from eighteen to twenty miles long, and the smallest from six to seven miles long. They are all covered with glaciers and snowfields, with bluff, black headlands on the southern exposures, whereon was vegetation. A large quantity of Arctic flowers and other specimens was collected and brought home. On one of the islands close to the harbor were hills 1200 feet above the level of the sea, but large tracts of flats were seen stretching from the foot of the hills.

The final trip from Eira Harbor was made on August 24, and it was on that day that they reached the most northerly point yet attained in that direction—80° 20′ north latitude, and about 40° east longitude. From that point they could see land to the north-west, some 40 miles off, and it was supposed that this was but a continuance of the same coast line. This they intended to follow up, but they had again to give up the attempt in consequence of the ice driving along the shore and carrying the ship along with it. Mr. Leigh Smith's opinion is that, whether this land extends in a continuous line north-west or forms the outline of separate islands, it forms a very good basis whence to prosecute researches further northward. When they found further progress impossible they returned, and experienced very bad weather.

They made for Eira Harbor again, but found it full of loose ice. Proceeding eastward, they anchored in a small bay to the west of Barent's Hook. From that point they steamed south a little to clear a large quantity of ice that had come out of the fjords, and on the 30th of August they found themselves close to Cape Tegetthoff, which had been discovered by the Austrian expedition in 1873. In that expedition their vessel, the *Tegetthoff*, was abandoned, and the explorers persevered in their mission by means of sledges; but though they succeeded in establishing the existence of the land, they had to return and make for Nova Zembla in a boat. Mr. Smith made a search for any traces of the abandoned vessel, but found nothing except a "can" on Wilczek Island. They found fast ice between Hall Island and Salm Island, and also between the latter island and Lamont Island, so that there was no means of getting out to the east or north-east, and as the ice was coming down they resolved to try to cut across by Spitzbergen to Wiches Land, or, as otherwise called, King Charles Land. In this endeavor their common enemy, the ice, confronted them and compelled them to alter their course. They sailed close to the edge of the ice as far as 75½° north and 46½° east before they could get west. They reached Hope Island on September 10, and again endeavored to work northwards up the east coast of Spitzbergen, but on the 11th the weather became very rough, and for three days the ship was tossed about in strong gales. They encountered numerous small icebergs. Seeing that nothing could be done in this direction—a pack of ice being discernible in the distance—they took a westerly course until they sighted the

South Cape, and then steamed up Storfjord and anchored on the 17th near Genevra Bay. From a hill here they could see the sea to the eastward was clear of block ice, although icebergs could be seen floating about. From this point Wiches Land could be distinctly seen. Hinlopen Straits also seemed to be free of ice. On the 20th they anchored at the entrance of Walter Thymen's Straits—where they took in ballast—which were also clear of ice. On the 22d they were off Wales Point, and from there they sailed with a fair wind to Hammerfest, in Norway, which they reached on the 25th of September.

Careful observations were taken of the temperature and other meteorological tests made. The dredgings secured some very interesting specimens which have been preserved, and a large number of photographs of the places visited were obtained.

Mr. Leigh Smith's voyage is the most successful and important *summer* voyage that has ever been made in the Arctic Regions.

MICROSCOPY.[1]

PATHOLOGY OF ACUTE DELIRIUM. — Dr. Theodore Deecke, Pathologist to the New York State Lunatic Asylum at Utica, publishes in the *Am. Journ. of Insanity*, a paper on some changes in the ganglion cells of the gray cortex of the brain in acute delirium and their relation to those in acute insanity and in dementia. He disputes the opinion of some authors that the phenomena of delirium, as well as acute insanity itself, are merely functional, and, while associated with grave disturbances of nutrition, and perhaps material alterations in the vascular system, are not connected with any visible alterations in the structure of the nervous elements themselves. The first change noticed in the ganglion cells of the gray cortex of the brain, is the appearance over the body of the cell of a loose, granular covering, of a fatty nature, which must be attributed to a defective focal combustion or oxidation, brought about by an insufficient supply, to the tissues involved, of arterial or oxygenated blood. These conditions occur so frequently in cases of acute delirium, and acute insanity, that there can be no doubt of their pathological character. In more advanced stages of the affection, the structure of the cells becomes involved, and finally almost entirely destroyed, as described at length in the paper itself. The author's method of studying the objects in situ, with as little change as possible from their condition in life, is thus described: "The best results are obtained from the immediate examination of the fresh brain tissue. With a sharp knife, kept wet with water, to which a small quantity of glycerine has been added, or even directly in this liquid, microscopic sections can be made sufficiently thin and transparent to permit the use of all the higher magnifying powers applicable in histological investigations. The liquid in which the sections are

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

mounted is diluted glycerine; and no pressure is allowed to act upon the specimens other than that which the thin cover-glass exerts when of the embedding fluid so much is removed by blotting paper that it just fills out the empty space between the slide and the cover. Thus the margin only of the specimen comes in contact with the fluid, while its surfaces are spread out smoothly on the glass surfaces. In such preparations the vascular arrangement, the distribution of the nuclei of the neuroglia, and the ganglion cells and nerve fibers in their natural appearance and position, are brought to view with great distinctness. The long processes of the pyramidal cells, which extend toward the periphery of the convolutions, may be followed up to three and four times the diameter of the field of vision of a one-fifth objective. The condition and position of the nuclei and nucleoli of the cells can be clearly pointed out, as also the roots at the base of the cells, and their origin. All this, however, will not visibly be altered when the fresh sections are soaked for staining in a carmine solution, to which a little glycerine has been added. They imbibe a small amount only of the coloring material, yet some details of structure may become thus more distinctly outlined. I have, therefore, most frequently in successive sections employed alternately both methods."

Fine Rulings.—In speaking of the modern microscopic rulings on glass, which have been regarded with so great and deserved an interest by all physicists, one cannot be too careful to discriminate fully between those that are known to be ruled and those whose ruling has been attempted but not yet demonmonstrated. It is self-evident that in attempting to rule lines 5,000,000 to the inch a band may be produced which does not consist of lines of that degree of fineness. There is no difficulty in arranging a machine to draw lines, theoretically, of any required degree of closeness. The register of a ruling engine can be so arranged and sub-divided as to indicate a spacing at the ruling point of one ten-millionth of an inch as easily almost as of one-tenth of an inch. But it may well be doubted whether such fine motion is actually imparted to the diamond point, or could be recorded upon the surface of the glass. It is becoming common to hear the higher bands of Mr. Fasoldt, claiming up to ten million lines to the inch, spoken of as actually ruled and only waiting an objective to reveal them. Such an error, made inadvertently by persons who would avoid it by a little reflection, as made in the last number of one of the most popular microscopical journals, gives a lasting as well as erroneous impression to non-scientific persons. Mr. Fasoldt's rulings are certainly remarkable and the lower bands are ruled with great success; but how far up the scale they continue to be ruled as distinct lines is certainly at this time an undecided question.

Ye Microscope of ye Olden Time.—Under this title Professor E. F. Moody delivered an interesting lecture before the Microscopical Society of Camden, which has just been published in pamphlet form by the society. Incited by an engraving and description of John Marshall's new double microscope in the Lexicon Technicum, published in 1704, which presents many of the features of the instruments and their methods of arrangement and use at the present day, he reviews the history of the microscope and its discoveries in England during the last of the 17th and the early part of the 18th century, chiefly by means of extracts from the Philosophical Transactions of the Royal Society. The author is greatly impressed with the keenness of observation, scientific skill and rare deductive power which is displayed in the microscopical studies of those early days, and he gives them in the quaint and thoughtful words of their original publication. After the death of Lewenhoeck, and the acquisition by the Royal Society of his valuable legacy, consisting of a cabinet containing his microscopes and their accompanying objects, this brilliant age of microscopy came to an end, and the Transactions show nothing of corresponding interest until the sudden advent of the age of Wollaston near the end of the 18th century.

Abnormal Entozoa in Man.—Rev. Samuel Lockwood's paper on this subject, read before the New Jersey State Microscopical Society, is full of curious facts in regard to the rather unfamiliar and somewhat unprepossessing theme. It is published in full in the January number of the *American Journal of Microscopy*.

Exchanges.—Parties desire to correspond with persons who can furnish new material containing *Polycistina;* also *Poduræ* or spring-tails of various species. Address the Editor of this Department of the Naturalist.

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SCIENTIFIC NEWS.

— The first number of *Papilio*, organ of the New York Entomological Club and devoted exclusively to Lepidoptera has made its appearance, and a very neat and pleasing one it is. It will be issued about the fifteenth of each month, the subscription price being $2 per annum. The publication committee are Messrs. A. R. Grote, Henry Edwards and T. L. Mead; subscriptions and communications should be addressed to Mr. Henry Edwards, 185 East 116th street, New York City. We hope that the journal will give stimulus to our knowledge of the metamorphoses of the Lepidoptera, which has been somewhat neglected; the paper of Mr. Coquillet on the early stages of some moths is, we hope, an earnest of what may follow. A number of new species of moths are described by Messrs. Grote, Neumoegen and Edwards; and the number is illustrated by a colored plate of *Edwardsia brillians* Neumoegen.

— One of the most industrious of European entomologists, and one whose works have excited a decided influence on the progress of American entomology, died December 30. We refer to M. Achille Guenée, whose general works on Lepidoptera contained descriptions of numerous North American Noctuidæ, Phalænidæ and Pyralidæ. In 1872 we visited the veteran entomologist at his residence in Chateaudun. During the Franco-Prussian war he took refuge in Geneva, where he worked at his favorite science. His works are thorough, reliable and comprehensive, and have been of incalculable value to American students. He was a lawyer by profession, was an officer of the French Academy, and received honors from various scientific societies.

— Zeitschrift für Instrumentenkunde, Organ für Mittheilungen aus dem gesammten Gebiete der wissenschaftlichen Technik is a new journal, devoted to a new subject, that of instruments used in physical and biological science. The list of editors is headed by Prof. E. Abbe of Jena, and undoubtedly represents a strong editorial corps; the *redacteur* or immediate editor is Dr. Georg Schwirkus. The journal occupies a new and important field, and will be of value to microscopists, as it contains a number of articles on microscopical and accessory instruments. It is of large octavo size, published at Berlin, by Julius Springer, the agents in this country being B. Westermann & Co. Price $4.50 a year by mail from Berlin.

— A full grown chicken was brought to the market of Shelbyville, Tenn., which was found to possess three legs. A *post mortem* examination, made by Dr. Fite, revealed the fact that the internal economy was even more queer than the extra leg. The craw, heart and lungs were natural, but the intestine, about midway of its length, subdivided into four distinct canals; these finally became reunited into one, and this, just before emerging from the body, divided into two distinct vents. The chicken was found also to have two distinct livers one on each side. The monstrosity is a fat and healthy looking subject.

— M. Humblot has lately sent to the Paris Museum of Natural History a fine collection of the mammalia and birds of Madagascar. They afford interesting illustrations of the modifications of which species are capable. M. Humblot has also sent home some live animals, whose habits are scarcely known. Among these are two Aye-Ayes (a mammal very singular in its organization, and of extreme rarity). Two species of *Hapalemur* were also sent (alive). They differ more from the makis than was previously believed.

— The Vienna Academy of Science proposes as the subject for the Baumgartner prize of 1000 florins, the microscopic investigation of the wood of living and fossil plants, in order to ascertain whether it is possible to determine with certainty, from the examination of the microscopic sections, what the genus and species of the plants may have been from which they were taken.

— Mr. Angelo Heilprin was recently elected to the position of professor of invertebrate palæontology in the Academy of Natural Sciences of Philadelphia. Henry Carvil Lewis was elected to the chair of geology and mineralogy in the same institution. Mr. W. B. Scott has been made assistant professor of geology in the College of New Jersey.

— Étienne Mulsant, the veteran entomologist of Lyons, France, died Nov. 4th, 1880, at the age of 83. For half a century he has been one of the most active and voluminous of European entomologists, having published numerous volumes and memoirs chiefly upon French beetles.

— We have received the First Annual Report of the Museum of the Ohio Wesleyan University. Valuable collections of fossils and shells have been received, and the Museum appears to have been well remembered by its friends. Prof. E. T. Nelson is the curator.

— Nests and Eggs of the Birds of the United States, with text. By Thomas B. Gentry. Illustrated by elegantly colored lithographic plates, is announced by J. A. Wagenseller, Philadelphia. The work is not to exceed twenty-five monthly parts, at $1.00 a part.

— The Botanical Collector's Handbook, by W. W. Bailey, Instructor in Botany and Curator of the Herbarium in Brown University, is ready for the press and will be published this spring by Mr. George A. Bates, Salem, Mass. The price will be $1.50.

— The Ninth Annual Report of the Curators of the Museum of Wesleyan University for 1880 shows that unusual interest is being manifested in the perfection of the collections. Prof. W. D. Rice is the Curator; Henry L. Osborn, Assistant Curator.

— It has been recently shown by Dr. Fatio that natural-history collection (dry preparations) may be rapidly, easily, and without danger, freed from their various parasites by simple spraying of anhydrous sulphurus acid in their receivers.

— The skeleton of a finner whale from the Pacific ocean has just reached the Permanent Exhibition of Philadelphia, for Professor Cope. Its weight is over 12,000 pounds. Sixteen boxes of fossils arrived from Paris at the same time.

— The Belgian Entomological Society recently celebrated its twenty-fifth anniversary. Baron de Selys-Longchamps, the first President, to whom the Society owes so much of its success, was unanimously elected Honorary President.

— We have received a list of plants growing without cultivation in Malden and Medford, Mass., with some contributions to a

Flora of Middlesex county. Published by the Middlesex Institute.

— Professor E. T. Cox, formerly director of the Geological Survey of Indiana, is engaged in examinations of the antimony mines in Sonora.

— Dr. C. Parona, of Pavia, has recently published an essay on the Acinetæ in general, and described a new Italian form.

— The triennial meeting of the American Institute of Mining Engineers was held in Philadelphia, Feb. 15, 1881.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Boston Society of Natural History, Jan. 19.—The meeting was devoted to archæological topics. Dr. C. C. Abbott, of Trenton, N. J., discussed the evidences of palæolithic man in the valley of the Delaware. Professor Henry W. Haynes compared the argillite implements found by Mr. Abbott with those of the palæolithic age in Europe. The Rev. G. Fred. Wright considered the age of the Delaware gravels. Remarks on these subjects were made by Mr. F. W. Putnam and others.

Feb. 2.—Mr. William Trelease spoke of the fertilization of *Salvia splendens* by birds. Mr. F. C. Bowditch remarked on the economy of the beehive. Mr. F. W. Putnam exhibited an Indian relic from the peat; and Mr. Lucien Carr spoke of the raising of corn by the Indians east of the Mississippi.

Troy Scientific Association, Jan. 17, 1881.—Mr. Wm. E. Hagan read a paper on the intellectual development of the United States.

New York Academy of Sciences, Jan. 3.—Mr. Thomas Bland read a paper on the relations of the flora and fauna of Santa Cruz, West Indies.

Jan. 10.—Dr. George M. Beard lectured on trance, or so-called hypnotism or somnambulism, its nature symptoms and varieties, with especial reference to mesmeric trance. His experiments were conducted on a class of human objects that have been under Dr. Beard's training, and with especial reference to the errors of prominent European observers.

Appalachian Mountain Club, Jan. 12.—President Cross delivered the annual address on the subject of barometric measurement of heights; and Professor J. R. Edmands read a paper on schemes for Appalachian maps.

Middlesex Institute, Jan. 5.—Frank S. Collins read a paper on "Darwinism." Twelve new names were added to the list of members. The first publication of *The Institute* was issued in the form of a catalogue of the plants of Malden, Medford and vicinity, with blank pages for notes preparatory to the final compilation of a complete catalogue of the counties' flora.

American Geographical Society, Jan. 11.—Commander J. R. Bartlett, U.S.N., read a paper on the recent investigations of the Gulf Stream by the U. S. Coast and Geodetic Survey steamer *Blake*.

Jan. 25.—Gen. G. W. Callum read a paper on the Land of Egypt.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

American Journal of Science and Arts.—February. Notes on Alaska and the vicinity of Behring strait, by W. H. Dall. Relation of Devonian insects to later and existing types, by S. H. Scudder. Date of the Glacial era in Eastern North America, by G. F. Wright. A new genus and species of air-breathing mollusk from the coal measures of Ohio, by R. P. Whitfield. Principal characters of American Jurassic Dinosaurs, by O. C. Marsh, Part IV.

Annals and Magazine of Natural History. — December, 1880. Note on *Pterygodermatites macdonaldii*, the type of a new order of Vermes, by G. E. Dobson. On the minute structure of the recent *Heteropora neozelanica* and on the relations of the genus Heteropora to Monticulipora, by H. A. Nicholson. On the northern species of Buccinum, by J. G. Jeffreys. On the organization and development of the Gordii, second note by A. Villot.

Geological Magazine—January. On the ornithosaurians from the Upper Greensand of Cambridge, by H. G. Seeley.

Quarterly Journal of Microscopical Science—January. On the germination and histology of the seedling of *Welwitschia mirabilis* by F. O. Bower. On the head-cavities and associated nerves of Elasmobranchs, by A. M. Marshall. Contributions to the minute anatomy of the nasal mucous membrane, by E. Klein. Histological Notes, by E. Klein. On the intra-cellular digestion and endoderm of Limnocodium, by E. R. Lankester. (Shows that in the Cœlenterates, as previously shown by Metschnikoff, the endodermal cell take in natural food materials. In the fresh water medusa Lankester has studied the amœboid endodermal cells during life and seen them take in natural food materials, such as Protococcus and Euglena-like forms. He cites the observation of Parke, who saw a diatom completely embedded in the protoplasm of a cell of Hydra, also of Metschnikoff, who has described the inception of solid food particles by the cells lining the alimentary canal of certain Planarians.) On the microscopic numeration of the blood corpuscles and the estimation of their hæmoglobin, by Mrs. E. Hart. Preliminary account of the development of the lampreys, by W. B. Scott. On some appearances of the red blood-corpuscles of man and other vertebrata, by G. F. Dowdeswell. Medusæ and Hydroid polyps living in fresh water, by G. J. Romanes.

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THE FERTILIZATION OF SALVIA SPLENDENS BY BIRDS.[1]

BY WILLIAM TRELEASE.

IN the fall of 1878, while studying the structure of various flowers, as correlated with the mode of their fertilization, I examined *Salvia splendens* Sellow,[2] a Brazilian species very commonly cultivated for its large scarlet flowers. From the structure as then made out, I was partially convinced that I was not dealing with an entomophilous flower; but it was not until two years later that I had an opportunity to look into the matter any further, and I then became certain that the species was one of the more closely adapted ornithophilous plants.

The flowers, arranged in a compound raceme, are placed horizontally or nearly so. Nectar, secreted by a large, lobed disk (*n*), as usual in the Labiatæ, accumulates in the basal part of the corolla, and offers a considerable amount of tempting food to nectar-loving creatures, and this, advertised by the brilliant scarlet of the calyx and corolla, clearly proclaims the flowers to be zoöphilous, or adapted to fertilization by animals of some kind.

The corolla is tubular, though somewhat laterally compressed, and reaches a length of not far from two inches. It possesses the bilabiate character which has given a name to the natural

[1] Read before the Boston Society of Natural History, Feb. 2, 1881.

[2] Professor F. Hildebrand, in his paper on the fertilization of Salvias by insects (Pringsheim's Jahrb. wiss. Bot., 1865, IV, p. 459, and Pl. 33, figs. 8 and 9), describes and figures the floral structure of a species to which he gives this name, but which is quite different from that on which my observations were made, which, it may be added, has been found to agree with authentic specimens of *S. splendens* in the Gray Herbarium.

order to which it belongs, and, as is generally the case with labiate flowers, the lower lip is split into three lobes, a median and two lateral, which in this case are of nearly equal size. Here, however, the lower lip—usually well developed and affording a convenient landing place for insects—is small and of little or no use for this purpose.

The style is exserted to a considerable distance, and the included portion is held quite firmly in a longitudinal fold of the upper part of the corolla tube. The forked stigma (*st*) is thus maintained in the median plane of the flower.

The stamens are two in number, and of the general form found in this genus. Their filaments are adherent to the corolla to within a short distance of its mouth, where they become free, and run obliquely upward and forward, terminating side by side, close beneath the base of the upper lip. The connective which in many flowers forms an inconspicuous band between the anther cells, is here prolonged, in each stamen, into a slender longitudinally-placed rod nearly an inch in length. Each connective (*c*) is attached at its middle by a hinge joint to the end of its filament, thus forming an oblique lever with equal arms, which lies with its anterior end *a* in contact with, or barely protruding from the tip of the arched upper lip of the corolla, while its posterior end *a'* nearly reaches the floor of the tube. If this were constructed as the stamens of related plants are, it should bear an anther cell at each end; but in reality only a single fertile cell—the anterior—is developed, the posterior cell being abortive. Moreover, the connectives of the two stamens are coherent for a short distance back of their insertion, so that the two form, in reality, a single forked lever.

When a flower first opens, the stigma is immature, its lobes being closely appressed, as shown in the upper part of Fig. 2, but the anthers are already dehiscent. In other words the species is proterandrous. Later, when some or all of the pollen has been removed, the stigmatic lobes expand, as shown in the lower part of Fig. 2, and expose the now receptive surfaces, and the style curves down into the position shown by the dotted line of Fig. 1. From my observations, I should say that the life of a given flower may be divided into three periods; in the first, the anthers only being mature, it is staminate in function; in the second, some pollen remaining in the anthers, while the stigmas become receptive, it is functionally hermaphrodite or perfect; and in the third, the pollen having been entirely removed, while the

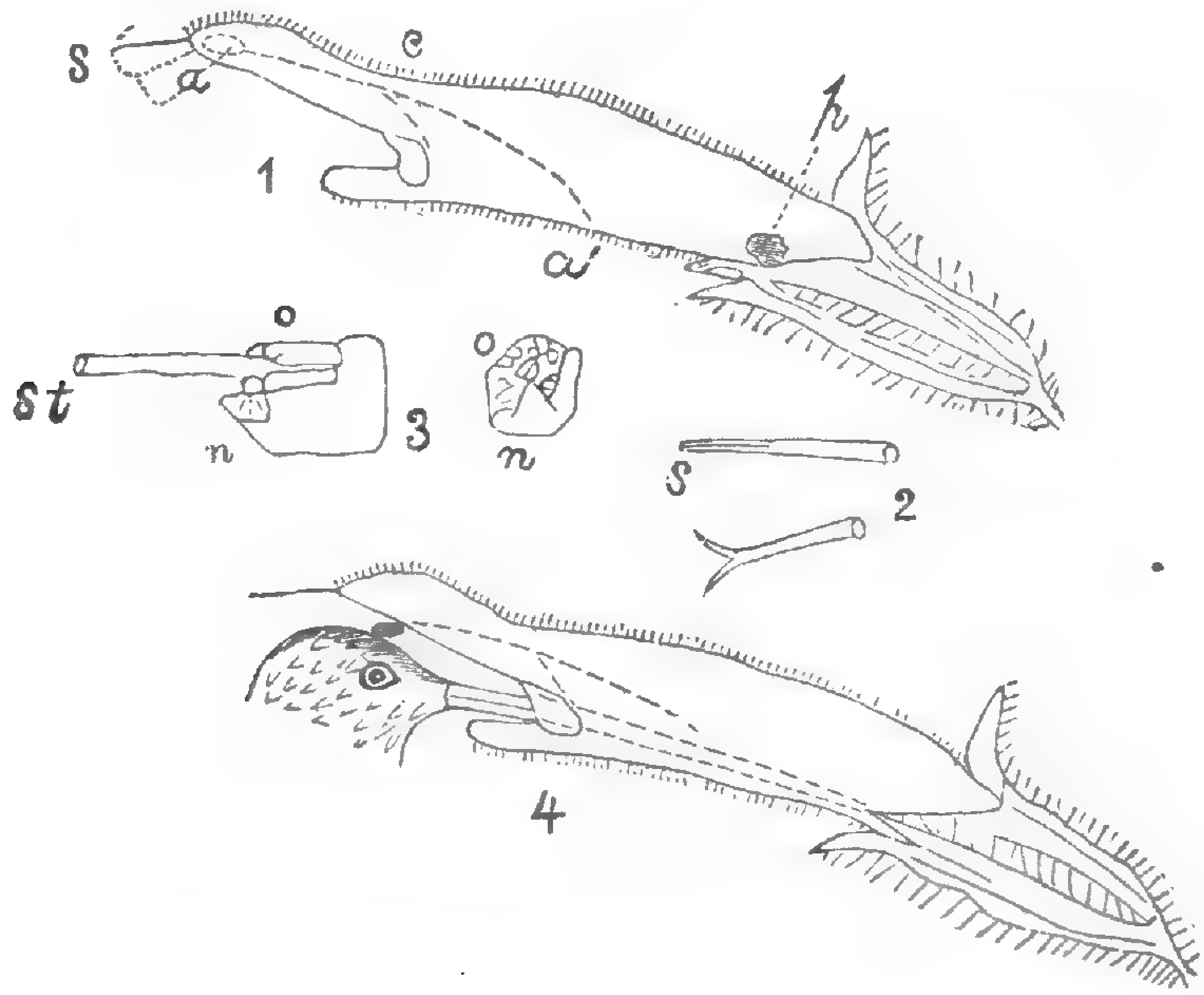

FIG. 1.—Young flower of *Salvia splendens*, seen from the side. The position of the connective and filament is shown by dotted lines, as also the position assumed by the style in older flowers. FIG. 2.—Stigmas; the upper from a newly expanded flower, the lower from a flower which has been open for some time. FIG. 3.—The nectar gland and ovary. FIG. 4.—A flower visited by a humming bird; Figs. 1 and 4 natural size; Figs. 2 and 3, enlarged four diameters; *a*, indicates the fertile anther cells; *a'*, the sterile cells; *c*, the connective, at the point where it is hinged to the filament; *n*, the nectar gland; *o*, the ovary; *p*, a perforation of the corolla, made by ants for access to the nectar; *s*, the stigma; *st*, the style.

stigma, if unfertilized, retains its freshness, it is pistillate only so far as function is concerned.

It appears at once that there is little likelihood of pollen reaching the stigma without some sort of assistance, and the proterandry decreases the chances for a given flower to be fertilized by its own pollen when such assistance is rendered, though from the apparent incompleteness of the dichogamy this may occur in some instances.

Many species of Salvia are perfectly adapted to profit by the visits of bees, usually humble bees, which, in entering the flower for nectar, encounter and elevate the posterior end of the connectives with their heads, thus bringing the polliniferous anterior end upon their backs and dusting them with pollen, which will be brushed off, in part, by the stigma of the next older flower visited. When the insect leaves the flower, the stamens, returning to their former position through the elasticity of the parts, are ready to make their bow to the next comer. Two facts, however, argue against the adaptation of the present species to bees:

1. The narrow and elongated tubular form of the corolla quite effectually excludes those which are large enough to set the lever in motion; 2. If such an insect, for instance a hive bee or small humble bee, should force its way into the tube, by the time its head had reached and elevated the sterile end of the lever, the tip of its abdomen would have passed the lowering polliniferous end, so that no pollen would reach the insect, and the object of the motion would be defeated. Bees might, to be sure, visit the flowers solely for their pollen, and I have no doubt that they occasionally do so, in which case they must often render some service in their fertilization, as is the case in so many flowers visited for pollen alone. Bees being excluded for the reasons above given, we turn to Lepidoptera, which sometimes visit the flowers, their long and slender proboscides enabling them to reach the nectar with little exertion; but it remains to be shown that these organs are sufficiently large or rigid to set the stamens in motion. Even if it should be shown that the large nocturnal moths do move the levers, which I am far from believing to be the case, the brilliant scarlet color is one ill adapted to rendering the flowers conspicuous in the twilight or night, and, so far as I know, one which is never possessed by flowers especially dependent upon these insects for their fertilization; beside which, we do not find that close constriction of the mouth or anterior part of the corolla bespeaking adaptation to the Lepidoptera. It appears, then, that when these insects visit the flowers of our sage, they may be of some use in transferring pollen, since their heads may encounter stigma and anthers, but they do this without rendering the motility of the latter of any value.

The only alternative, then, is birds, which, to be of the highest use in this connection, must be found in the native habitat of the plant, must visit flowers frequently for nectar, small insects attracted by the latter, or for both, and finally, must have slender and elongated beaks capable of insertion into the tubular flowers. All of these conditions are fulfilled by many of the humming birds, which reach their greatest number in both species and individuals in Equatorial America. The color of this Salvia is one of the most attractive to humming birds, and a glance at Figure 4 will show that one of those with an elongated beak cannot fail to operate the lever in the most perfect manner; its extensible tongue, however, rendering it by no means necessary for its beak to equal the corolla in length.

In a brief note published in the *Botanische Zeitung* for 1870, p. 275, Fritz Müller states that in Brazil the scarlet Salvias are frequently visited by birds, and although no species are named, there is little reason to doubt that the one under consideration was among those observed. Our single species of Trochilus, the ruby throat, possesses a beak rather short for the most efficient working of the staminal lever, yet from the statements of friends and from personal observation I can vouch for its frequently rendered service, and the greater part of the capsules of this plant which mature in our borders are to be credited to this active little creature.

Although this paper is confined to a single species of Salvia, it by no means follows that others may not offer examples of equal or even of greater adaptation to birds, and several such might be mentioned. The conclusion seems, on the whole, warranted, that several tropical American Salvias are as perfectly adapted to profit by the visits of birds as many other species of the genus are to profit by the visits of bees.

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ON THE ORIGIN OF THE FOOT STRUCTURES OF THE UNGULATES.

BY E. D. COPE.

THE following considerations have been suggested by a study of the primitive types of the odd and even-toed ungulates. I first, in 1874, recorded the opinion that the *Mammalia* with a reduced number of digits were derived from pentadactyle plantigrade types.[1] The ungulate order which fulfills this requirement is the *Amblypoda*, and from them, I doubt not, both the *Perissodactyla* and *Artiodactyla* have arisen, although not from any of the genera now known. Both of these great orders display a regular diminution in the number of the digits; in the former, by reduction and extinction on both sides of the third digit; in the latter, by reduction and extinction on each side of the third and fourth digits. Mr. John A. Ryder[2] has pointed out that reduction in digits is probably directly related to strains and impacts. He reminds us that the anterior digits are reduced in *Mammalia* of unusual scansorial or fossorial powers; while in forms which display

[1] Journal Academy Philadelphia, March, 1874.

[2] American Naturalist, October, 1877.

powers of running, the reduction is seen first in the posterior feet, which propel the body much more than the fore feet. This view is well illustrated in the Perissodactyle families, the majority of which have the digital formula 4—3.

No reason has ever been suggested, so far as I am aware, in explanation of the fact that one series of ungulates has retained two digits, and the other only one; that is, why there should have been two kinds of digital reduction instead of one kind. In seeking for an explanation, we will remember that the tarsus in the odd or single-toed line, is bound together by fixed articula-

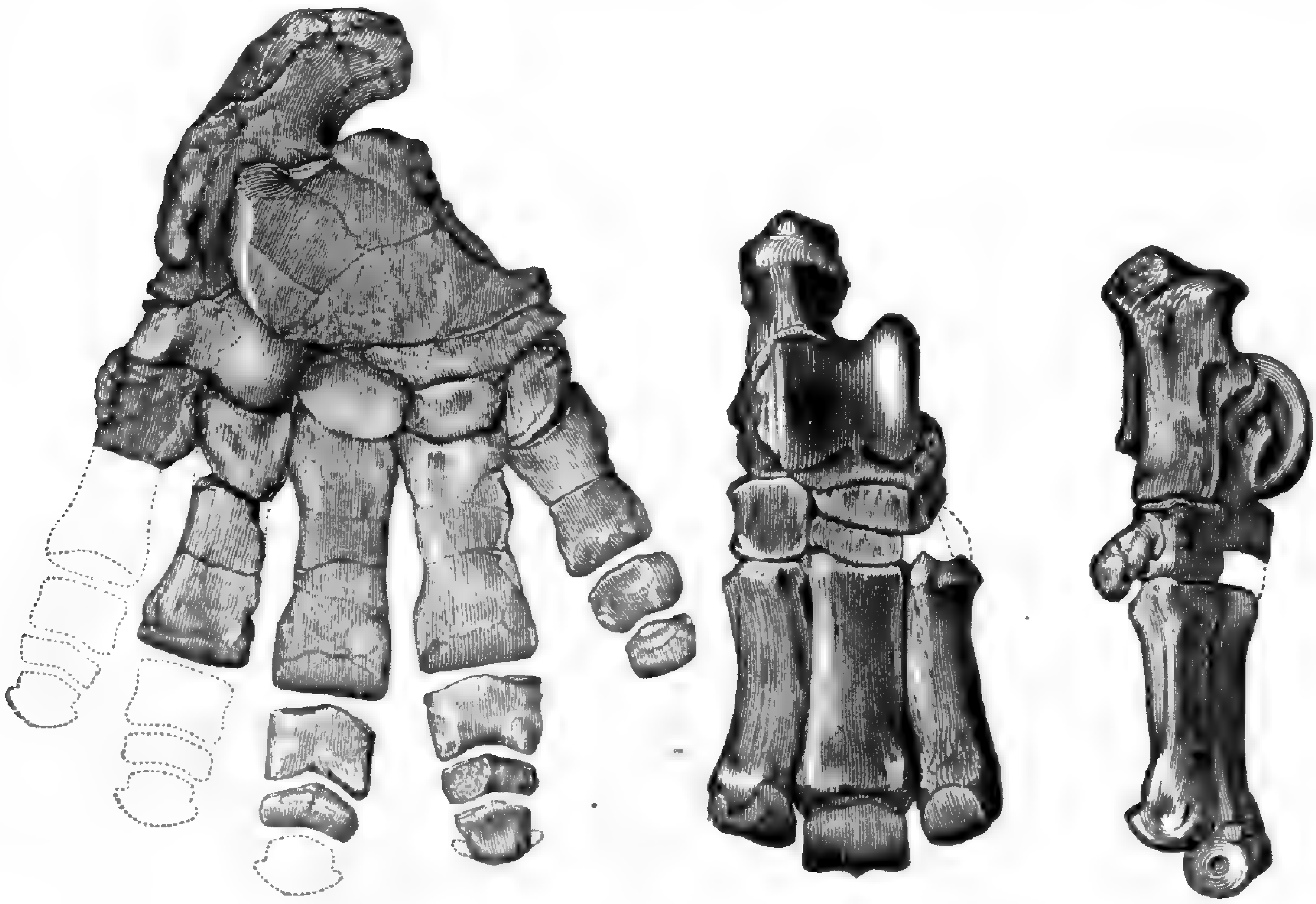

FIG. 1. FIG. 2.

FIG. 1.—Right posterior foot of a species of *Coryphodon* from New Mexico, one-half nat. size. From Report Expl. W. of 100th Mer. G. M. Wheeler, IV. Pl. LIX.

FIG. 2.—Right posterior foot of *Aphelops megalodus* Cope, from Colorado, one-half natural size. From Report U. S. Geol. Surv. Terrs. F. V. Hayden, IV, Pl. CXXX.

tions, while in the cloven footed line it is interrupted by the hinge between the first (astragalus), and second rows of bones. The hinge-joint being more liable to luxation than the fixed articulation, requires a wider basis of support, such as would be furnished by two divergent digits, rather than by a single central one.

In the early types, where the median digits are slender, the mechanical advantage in favor of the bidigital over the unidigital arrangement is much more obvious than in modern genera. Late in time, the horse developed the middle digit to such a width as to form almost as good a support as the bidigital structure. In the Eocene genera, the slender median digit could not have sustained the weight on a hinge, without great risk of dislocation. This explanation it can be said, applies only to the posterior foot. The posterior foot has, however, led the way in the evolution of *Ungulata*, and the fore foot may have followed in accordance with the law of antero-posterior symmetry in growth. A curiously malformed deer from Mendocino county, Cal., throws some

FIG. 3.

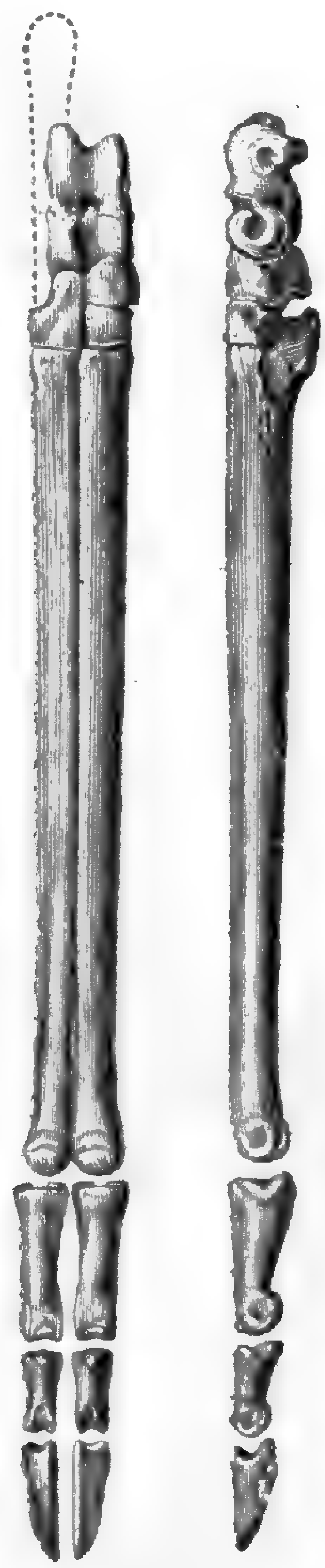

FIG. 4.

FIG. 3.—Right posterior foot of *Protohippus sejunctus* Cope, from Colorado, about one-half natural size. From Report U. S. Geol. Surv. Terrs. F. V. Hayden, IV.

FIG. 4.—Right posterior foot of *Poëbrotherium labiatum* Cope, from Colorado, three-fifths nat. size. From Hayden's Report, IV, Pl. CXV.

light on this subject. It has apparently a single functional digit on each foot. Examination shows that the posterior foot is bidigital, but that the phalanges are fused; while the anterior foot is perissodactyle, all the digits but the third being rudimental! Similar evidence is furnished by the genus *Eurytherium* of the French Eocene. Its posterior foot is modified artiodactyle, while the anterior is modified perissodactyle. We may assume from these facts, that the posterior foot is more subject to the influences which tend to produce the bidigital structure than is the anterior limb.

I suspect that the production of a ginglymus in the middle of the tarsus, has been due to the use of the posterior limb in soft swampy ground. In the absence of this condition, as in a life on harder ground than swamp, no ginglymus would be formed. The action of an ungulate in walking through deep mud is very suggestive. The posterior foot is bent on the leg, and the antero-posterior strain of the weight or propulsive force, is transverse to its long axis. In progression on dry land, the impact is in the direction of the length or axis of the foot. The obvious effect of a cross strain is to produce by degrees greater and greater mobility of some articulation. The one which has yielded is that between the two tarsal rows. Another effect of walking in swampy ground is to spread the digits apart. As the first digit of both feet is always of reduced size, there are practically but four digits to be considered. The weight falling nearly medially on these, would tend to spread them equally, two on each side. Thus the same cause may have been effective in producing both the artiodactyle structures. The perissodactyle structure, so soon as the lateral digits are much reduced, ceases to be favorable for progression in soft ground, owing to the liability of the lateral digits to injury, in following the principal one into the yielding material, filled with sticks and other hard débris.

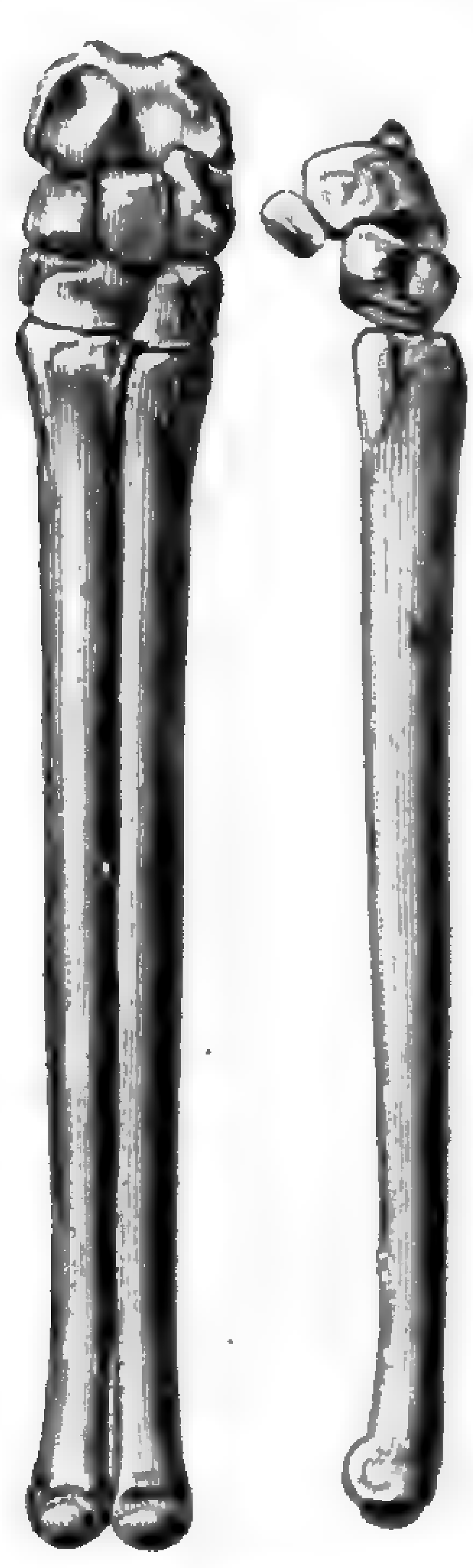

FIG. 5.—Left fore-foot with part of radius of *Poëbrotherium vilsoni* Leidy, from Colorado, three-fifths nat size. From Hayden's Report, IV, Pl. CXV.

The lowest existing forms of the *Artiodactyla*, the *Omnivora*, are universally swamp lovers and livers. So we are told are the lower existing *Perissodactyla*, the tapirs and rhinoceroses. The higher types of both orders are dwellers on plains and in forests. We do not know the habits of the Eocene *Perissodactyla*, but I doubt their having inhabited muddy ground to the same extent as the hogs and hippopotami, the lowest of the *Artiodactyla.* Now in progression on dry land, any preëxistent inequality in the length of the digits would tend to become exaggerated. Such an inequality exists in the *Amblypoda,* the third digit being a little the longer. In rapid movement on hard ground the longest toe receives the greatest part of the impact, even if its excess of length is but little. The harder the ground the larger the proportion of impact it will receive.

The fact that the *Perissodactyla* did not develop the solidungulate or equine foot, until a late geological period, or in other words, that the orders so long retained the digital formula 4—3, would indicate that it did not adopt a habitat which required great speed as a condition of safety, so early as the *Artiodactyla.*

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PROGRESS OF INVERTEBRATE PALÆONTOLOGY IN THE UNITED STATES FOR THE YEAR 1880.

BY DR. C. A. WHITE.

THE palæontological work of 1880 has been done mainly by the same persons whose works were noticed in the NATURALIST'S review for 1879. None have died during the past year, and at least one new worker has appeared in the ranks of American palæontologists. With one important exception the channels for the publication of the results of palæontological work remains the same as last year. Palæontology has suffered a serious loss in the closing of the important channel of publication which was for so many years afforded by the Government Survey under the direction of Dr. Hayden. At present, therefore, no great works of well illustrated invertebrate palæontology are in progress, except those of New York, Ohio and Wisconsin, but more especially that of the first-named State.

Dr. Charles Barrois, of Lille, France, published in the *Revue Scientifique* (Paris), for September, 1880, a review of Volume v, Part II, Palæontology of New York, by Professor James Hall; and a translation of the same was published in the January, 1881, number of the *American Journal of Science.* In that review Dr. Barrois gives, besides a summary of the contents of the volume, some interesting discussion of the relation of the Devonian Gasteropoda, Pteropoda and Cephalopoda of the New York rocks with those of Europe.

Dr. J. W. Dawson, in the November, 1880, number of the *American Journal of Science*, published a "Revision of the Land Snails of the Palæozoic Era, with Descriptions of New Species;" pages 403-415, with numerous wood-cuts. In this paper Dr. Dawson describes the following species, the second and last being new forms: *Pupa vetusta* Dawson, with the variety *tenuistriata* Dawson, *Pupa bigsbyi* Dawson, *P. vermillionensis* Bradley, *Zonites (Conulus) priscus* Carpenter, *Dawsonella meeki* Bradley, *Strophites grandæva* Dawson. The descriptions are accompanied with interesting discussions of the relations of these shells with living forms.

In the January, 1880, number of the *American Journal of Science*, page 50, Professor W. B. Dwight has given an account of his discoveries of fossils in the Wappinger valley, or Barnegat limestone of Duchess county, N. Y., which is a continuation of the subject as treated by him in the May, 1879, number of the same journal. In this article he has enumerated many well-known forms belonging to the Trenton and Calciferous epochs, and proposed the name *Discina conica* for a new form which he refers to the age of the Trenton limestone; and which, in the June, 1880, number of the *Journal*, he describes and figures under the name of *Orbiculoidea conica*. Professor Dwight has also a brief article on the same subject in the January, 1881, number of the same journal, in which he claims for the lower series of those rocks the existence of "a wealth of Cephalopodic life of a character and abundance hitherto unknown in the United States in any formation to which it is likely to belong, *i. e.*, below the Trenton and Black River strata." He proposes to publish full details of his discoveries, with further results.

Mr. S. W. Ford has a note in the February, 1880, number of the *American Journal of Science*, on the *Atops trilineatus* of Emmons, in which he claims that the species figured by Emmons in his Taconic System, p. 20, and in the Agricultural Report of New York, Vol. I, p. 64, is not *Triarthrus beckii*, as supposed by Hall and Walcott, but that it belongs to the genus Conocoryphe.

Professor James Hall is still prosecuting his great work on the Palæontology of New York. Part II, of Vol. V, has been issued since my summary of last year's palæontological work was written, and Dr. Barrois' review of the same has already been noticed.

It is expected that Part I, of Vol. V, will soon be issued, and Vol. VI is also well in progress, thirty-nine of the plates being already engraved. During the past year Professor Hall has published, under the title "Corals and Bryozoans of the Lower Helderberg group," a pamphlet of thirty-eight pages, referring to twenty-two of the plates of Vol. VI, which volume is to be especially rich in those forms. He informs me that he has in preparation a supplement to Vol. V, Part II, for which there are already sixteen plates engraved. He also published, in the December, 1880, number of *Science*, a "Note on the relations of the Oneonta and Montrose sandstones of Vanuxem, and their relation to the sandstones of the Catskill mountains," which, although mainly geological, is still of considerable palæontological interest. Professor Hall states that the Oneonta sandstone is not a part of the Chemung group, as has been supposed, but that it constitutes a separate series of strata, the true position of which is between the Hamilton and Chemung groups, and expresses the opinion that those strata were deposited under "estuary and fresh-water conditions." He regards those shells which characterize these strata, and which were described by Vanuxem as *Cypricardites cattskillensis* and *C. angusta* as belonging to the genus Anodonta.

Professor A. Hyatt has nearly completed his illustrated memoir on the Ammonites of the Lower Lias, which is to be published by the Museum of Comparative Zoölogy at Cambridge, Mass.

Dr. G. Hambach has an interesting "Contribution to the Anatomy of the Genus Pentremites, with Description of New Species," in Vol. IV, Transactions St. Louis Academy Science, pp. 145–160, with two lithograph plates. He has in hand a monograph of all the known American and European forms of the Blastoideæ.

The appointment of Mr. Angelo Heilprin as Professor of Invertebrate Palæontology at the Academy of Natural Sciences of Philadelphia is a gratifying indication of progressive spirit in that well-known institution. In Vol. III, of the Proceedings of the U. S. National Museum, is to appear an article from his pen entitled, "On some New Species of Eocene Mollusca from the Southern United States," embracing pages 149–152, and accompanied with one plate of illustrations. He has also prepared an article for publication in the Proceedings of the Academy "On some new Lower Eocene Mollusca from Clark county, Alabama, with some points as to the stratigraphical position of the beds containing them." Professor Heilprin has also completed the preparation of a "Revision of the Eocene Mollusca of the Eastern and Southern United States," which, when published, will constitute a much needed addition to our palæontological literature.

Mr. S. A. Miller has continued his publications in the Journal of the Cincinnati Society of Natural History during the past year. He began a series of articles, mainly historical, in the October, 1879, number of the Journal, entitled "North American Mesozoic and Cenozoic Geology and Palæontology," which he has continued in each subsequent number to that of January, 1881. He informs me that it will be completed in the next April number, and that the whole series will embrace upwards of three hundred pages. In the January, 1880, number, Mr. Miller has three palæontological articles, entitled respectively, "Silurian Ichnolites, with definitions of new genera and species;" "Descriptions of two new species from the Niagara group and five from the Keokuk group;" and Note upon the habits of some fossil Annelids; the two first mentioned being illustrated. In the first named of these three articles he proposes six new generic names for as many different kinds of tracks which he has found upon the Lower Silurian slaty shales near Cincinnati. The July and October, 1880, number, and the January, 1881, number of the Journal, each contains an illustrated palæontological article from his pen, entitled respectively, "Description of four new species of Silurian fossils;" "Description of four new species and one variety of Silurian fossils;" and "Description of five new species of Silurian fossils, and remarks upon an undetermined form." Mr. Miller has also completed the MS. of catalogue of the North American Mesozoic and Cenozoic fossils, upon the same general plan of his catalogue of Palæozoic fossils published a few years ago, which he hopes soon to publish.

Professor A. S. Packard, Jr., in the July, 1880, number of the American Naturalist, has an instructive illustrated article on "The structure of the eye of Trilobites." In concluding this article Professor Packard says, "I now feel authorized in claiming that the Trilobite's eye was organized on the same plan as that of the Limulus, and thus when we add the close resemblance in the larval forms, in the general anatomy of the body-segments, and the fact demonstrated by Mr. Walcott that the Trilobites had jointed, round limbs (and probably membranous ones), we are led to believe that the two groups of Merostomata and Trilobites are sub-divisions or orders of one and the same sub-class of Crustacea for which we have previously proposed the term *Palæocarida*." In his memoir on the Anatomy and Embryology of Limulus, he also makes direct structural comparisons of the eyes of Trilobites and Limulus.

Mr. Samuel H. Scudder has published in the Bulletin of the Harvard College Library two installments of his Bibliography of Fossil Insects, and a third installment will soon be out. He has also completed a memoir on the Devonian Insects of New Brunswick for the Boston Society of Natural History, the general conclusions of which have appeared in the form of an article in the *American Journal of Science* for February. Besides these works he has in hand a paper on the geology and palæontology of Florissante, Colorado; and another on the structure and affinities of Euphorberia M. & W.

Advance sheets of two posthumous articles by the late Wm. M. Gabb, edited by Geo. W. Tryon, Jr., have lately been issued by the Acad. Nat. Sci. Philadelphia. They are entitled respectively, "Descriptions of Caribbean Miocene Fossils," and "Descriptions of New Species of Fossils from the Pliocene clay beds between Limon and Moen, Costa Rica, together with notes on previously known species from there and elsewhere in the Caribbean area." They comprise together pp. 337–380, and plates 44–47, inclusive, of the Jour. Acad. Nat. Sci. Philad. (2). Vol. VIII. In the latter paper Mr. Gabb has proposed the new generic name of *Parkeria* for a group of gastropods (not *Parkeria* Carpenter and Brady, a genus of Foraminifera).

Lieut. A. W. Vogdes published in the Proc. Acad. Nat. Sci. Philad. for 1880, p. 176, "Description of a new Crustacean, *Calymene rostrata*, from the Upper Silurian of Georgia, with remarks upon *Calymene clintoni*." Four wood-cuts.

Messrs. Wachsmuth and Springer have in press the second part of their Revision of the Palæocrinoidea, and also a supplement to the first part. It is the intention of the authors to complete this important work as soon as practicable.

Mr. C. D. Walcott has been long absent upon distant field duties, but he is known to have, in an advanced state of progress, some important investigations concerning the structure of Trilobites.

Professor A. G. Wetherby has continued his publications in the Jour. Cin. Soc. Nat. Hist. during the past year. In the January, 1880, number, he has an illustrated article entitled, "Descriptions of new Crinoids from the Cincinnati group of the Lower Silurian and the Subcarboniferous of Kentucky." Also in the July, 1880, number, "Remarks on the Trenton limestone of Kentucky, with descriptions of new Fossils from that formation and the Kaskaskia (Chester) group, Subcarboniferous;" likewise illustrated. In the last-named article Professor Wetherby proposes the new genus *Hybocystites.* The January, 1881, number of the same journal contains another illustrated article from his pen, entitled "Description of Crinoids from the Upper Carboniferous of Pulaski county, Kentucky." Besides these published articles, Professor Wetherby has two or three others in a forward state of progress.

In the June, 1880, number of the *American Journal of Science,* Professor R. P. Whitfield has an article "On the occurrence of true Lingula in the Trenton limestones," illustrated by two woodcuts. His remarks are based upon a new species from Minnesota, which he calls *L. elderi.* In the Annual Report of the Wisconsin Geological Survey for 1880, pp. 44–71, he has published "Descriptions of new species of Fossils from the Paleozoic formations of Wisconsin." He herein proposes a new generic designation for a group of corals which he states to be in all respects compound Cystophyllia, under the name of *Cystostylus.*

Professor H. S. Williams has an interesting article in the December, 1880, number of the *American Journal of Science,* entitled "Abstract of some palæontological studies of the Life History of *Spirifer lævis* Hall," upon a subject which may be properly designated synthetic palæontology. In this article Professor Williams traces a series of forms of Spirifer, which are known in different formations by different specific names, through the strata of all the formations, from the Niagara to the Chemung, inclusive, and says of these groups of shells: "There is nothing of a specific character evolved in this series of forms which did not appear in the first forms; but there is every evidence for the belief that the species has lived through this long geological time without losing its character, and that all that has resulted from great time and change of conditions has been the fixing into race-groups of the original variable characters of the species."

Professor N. H. Winchell, in his Eighth Annual Report of the Geological and Natural History Survey of Minnesota for 1880, describes ten species of brachiopods from the Trenton and Hudson River formations of that State.

The following articles and notes have been published during the year 1880 by the writer of this article: "Descriptions of new species of Carboniferous Invertebrate Fossils" (illustrated); "Note on *Endothyra ornata*;" "Note on Criocardium and Ethmocardium;" "Descriptions of new Invertebrate Fossils from Kansas and Texas" (illustrated); all in Vol. II Proceedings of the U. S. National Museum. In the first of these the genus *Lecythiocrinus* (not *Lecythocrinus* Müller nor Zittel) is proposed, and in the second the sub-genus *Ethmocardium.* Also in Vol. III of Proc. U. S. National Museum, "Note on the occurrence of *Productus giganteus* in California" (illustrated); "Note on Acrothele;" "Description of a new Cretaceous Pinna from New Mexico;" "Note on *Stricklandinia salteri* and *S. davidsoni* in Georgia;" "Description of a very large fossil Gasteropod from the State of Puebla, Mexico" (illustrated); "Descriptions of new Invertebrate Fossils from the Mesozoic rocks of Arkansas, Wyoming, Colorado and Utah." In the July, 1880, number of the *American Journal of Science*, he has an article "On the Antiquity of certain subordinate types of fresh-water and land Mollusca," in which it is shown that numerous types which characterize the living molluscan fauna of North America, had their origin at least as early as the earliest Eocene and later Cretaceous epochs.

The Contributions to Invertebrate Palæontology, Nos. 2–8, which in the NATURALIST'S summary for 1879, were announced as in press, have been published as a single extract from the Twelfth Annual Report of the U. S. Geol. Survey of the Territories, and embrace, besides 171 pages of text, thirty-two plates instead of twenty-eight, as then announced.

Besides the foregoing, which are already published, the writer of this article has in press a brief palæontological report to Capt. Geo. M. Wheeler, on some Carboniferous fossils from Northern New Mexico, with two quarto plates of illustrations; and also a report to Professor John Collett, State Geologist of Indiana, accompanied by eleven octavo plates of illustrations.

EVIDENCES OF THE EFFECT OF CHEMICO-PHYSICAL INFLUENCES IN THE EVOLUTION OF BRANCHIOPOD CRUSTACEANS.

BY CARL F. GISSLER, PH.D.

DURING the winter months *Eubranchipus vernalis* Verrill,[1] occurs near Maspeth, L. I., in immense numbers, in large communicating ponds containing clear, yellowish, fresh water. In January 1880 I found in a small and entirely isolated pool, less than a hundred paces from the above-mentioned place, a number of perfectly colorless, smaller, but sexually mature individuals of these branchiopod Crustaceans. The bottom of the pool is a white and very soft clay, and the water itself is of a milky color. I collected a number and observed the following differences:

A. Very few individuals of both sexes bearing, with the exception of the transparent body and the red furca of the post-abdomen, the same characters as Eubranchipus.

B. A great number of colorless individuals from fifteen to twenty-two mm. in length. These differ from the larger, red Eubranchipus, in the following particulars. Cephalic scute large and convex; basal joint of male clasper cylindrical; claspers crossing each other, short, tip of second joint with a blunt minute tooth; second joint more or less conical, tapering. A more full account I will soon give in Professor A. S. Packard's monograph on Phyllopod Crustaceans of the sexual organs, copulation and the biology of these colorless individuals.

C. A single specimen of male Chirocephalus.

D. A hermaphrodite. Sexual organs separate, both male and female claspers present.[2]

E. A single male individual with a minute tooth on the second joint of its right clasper; tooth wanting on the left. Left clasper in normal position, right clasper twisted around, thus apparently preventing the animal from using it in copulation. The tooth is probably a substitute for the distorted hook, and assumes its func-

[1] "Observations on phyllopod Crustacea of the family of Branchipidæ, with descriptions of some new genera and species." By A. E. Verrill, professor of zoölogy. 1869.

[2] I described this hermaphroditic form in AMERICAN NATURALIST, February, 1881, pages 136 to 139.

tion. This exemplifies Dr. Dohrn's theory[1] of the consecutiveness of functions whose bearings concern one and the same organ, brought about by evolution. I refer to papers by Professor Cope in the AMERICAN NATURALIST, "A review of the modern doctrine of evolution," etc.

Professor Moritz Wagner's migration theory,[2] as well as Dr. Charles Darwin's selection theory,[3] may be employed to explain the occurrence of the above-mentioned sets *A*, *B*, and probably also *C*.

First I must mention that, on keeping a number of Eubranchipus, male and female (the latter with ovaries filled and oviducts empty), together with a number of sets *A* and *B*, males and females (female in the same condition), during five days, I could never observe a single case of crossing; on the contrary, the two (red and white) avoided each other and only copulated among themselves. Now, as to set *A*, I consider them to be the first generation of Eubranchipus, brought along with mud into the little clay pool, by water birds, from the neighboring larger ponds.[4] The transparency of their bodies was produced by the chemico-physical influence[5] of the little clay pool, and not by "mimicry." As the pool is an isolated one, there was no chance for the absorbing or obliterating influences of crossing with the original red Eubranchipus; consequently the offspring of this new, colorless race, influenced by different factors, were liable to submit to still further evolutionary transformations which I believe have been realized in set *B*: The animal gradually degenerated into a much smaller one with the above-mentioned characters. The factor that produced it was a conservative one, favoring the preservation of

[1] "Der Ursprung der Wirbelthiere und das Princip des Functionswechsels." Genealogische Skizzen von Dr. Anton Dohrn. 1875.

[2] "Die Darwin'sche Theorie und das Migrationsgesetz der Organismen." Von Dr. Moritz Wagner. 1868. The refutation of Wagner's law of migration was attempted by my former tutor, Professor Dr. Aug. Weismann ("Ueber den Einfluss der Isolirung auf die Artbildung," 1872); owing to a misconception of Wagner's paper he combined his theory with Darwin's selection theory, whilst both theories considerably deviate from each other as regards the compelling mechanical cause. See also *Kosmos*, IV, April, 1880: "Ueber die Entstehung der Arten durch Absonderung." Von Moritz Wagner.

[3] "On the Origin of Species by Means of Natural Selection." 1859.

[4] J. A. Ryder in AMER. NAT., XII, page 703.

[5] See also papers by W. J. Schmankewitsch in *Zeit. für wiss. Zool.*, 1872, 1875 and 1877.

this new species.[1] The factor that produced the individual *E* was a compelling mechanical cause originating in a pathological condition. According to Dr. Darwin, the mechanical cause enters into activity with the appearance of "favorably varying" individuals whose morphological deviations are either inherited or adapted. As to *C*, the genus Chirocephalus, I have reason to suspect in the lobed and prolonged frontal tentacles only a product caused by either chemico-physical or a sudden change in climatological influences. The successive appearance of Chirocephalus and Streptocephalus in one and the same pond near Woodbury, N. J.,[2] rather strengthens my assumption.[3]

The hermaphroditic form *D* shows characters closely relating it to set *A*. From the study of comparative anatomy it follows that hermaphroditism, *i. e.*, the coëxistence of both male and female sexual organs in one individual, is the primitive condition of sexual differentiation, which may in time be followed by a complete separation of the sexes.[4] Hermaphroditism and parthenogenesis can be regarded as cases of atavism—as a reoccurrence of former, primitive conditions. Further progress in differentiation of the sexual conditions, Haeckel ascribes to "division of labor" (Arbeitstheilung). The bilateralism in this hermaphrodite indicates close relationship and coördination between the sexual organs and auxilliary copulation organs. According to Dr. Chas. S. Minot's theory,[5] it is possible that a male genoblast was formed by the splitting of a neutral cell on one side, and a female genoblast in the same manner on the other side of the post-abdomen at an early larval stage, and that then, as the animal became gradually more developed, the second pair of antennæ (not hitherto sexually distinguishable) transformed themselves symmetrically in accordance with the bilateral position of the genital glands and their exits. Unfortunately we are absolutely ignorant of the conditions which cause an animal, when capable of making genoblasts, to produce either male, female or hermaphrodite.

[1] Professor Huxley's "The Crayfish:" "In a strictly morphological sense, a *species* is simply an assemblage of individuals which agree with one another and differ from the rest of the living world in the sum of their morphological characters."

[2] J. A. Ryder, *op citat.*

[3] It is not impossible that branchiopod Crustaceans are liable to produce seasonal dimorphic individuals, a parallel to cases observed in Lepidoptera, according to Professor Sam. H. Scudder, Professor A. Weismann and others.

[4] Professor Ernst Haeckel's "Anthropogenie," pages 395, 681, etc.

[5] Amer. Nat., xiv, Feb., 1880.

NOTES ON A FEW OF THE DISEASES AND INJURIES IN BIRDS.

BY R. W. SHUFELDT, M.D., U. S. A.

IT is merely the object of this brief essay to call attention to the fact that has on so many occasions been so vividly presented to me, during the course of my dissections of bodies of birds and the preparation of their skeletons, of really how comparatively few of them there are that can boast of being perfectly free and exempt from *any* form of disease or the sequelæ of disease; and not to make any attempt to classify or write any extended description of those diseases and injuries to which birds are subject. One among the first cases that was brought to my notice occurred some fifteen years ago, while on a collecting tour in the State of Connecticut, at a period before I could lay barely any claim to the knowledge of disease or make any use of what I observed. In passing through the woods on that occasion I picked up from the ground a nearly full grown female *Molothrus pecoris*, that could barely hop along and was totally unable to fly. She was extremely emaciated and ill-nourished. My curiosity as to the cause of her disability was soon satisfied when I began to part the feathers to search for some injury that perhaps she had sustained. My first anticipations were quickly dispelled, for instead of any injury, I discovered the integument in various localities, particularly the wings and breast, raised up in rather a tent-like manner, in some eighteen or twenty places. Each of these little pockets was occupied by a yellowish-white larva as large as an ordinary white garden bean. These I easily removed, one by one, with a piece of straw, and carried my bird, apparently now much relieved, to the nearest water, some little distance, where she drank as if she had never beheld that fluid before. My surprise now was not very great when, upon releasing her, I found that she could fly some little distance, and undoubtedly subsequently entirely recovered. As I have never seen a similar case, I am to this day ignorant of the habits or even the name of the parasite.

Another remarkable, although common, case of parasitism occurs in Spheotyto, our burrowing owl of the plains. The best example of this I saw in one of these birds two or three years ago. This specimen, too, I could actually pick up from the entrance of the prairie-dog burrow, where he sat, scarcely caring, apparently, whether he lived or died. Upon removing, when in my study, the skin of this owl, I was not a little astonished to find many of the organs absolutely displaced by "wads" as large, in some instances, as an almond, of a long hair-like worm, of a pale yellow color, the longest being about 6 c.c. in length. Collections of them in the orbits forced the eyes outwards in this case, and a large roll of them occupied the upper third of the tracheo-œsophageal interspace, completely wedging the two tubes apart.

Subsequently when the skinless cadaver was thrown aside upon my table, these parasites reared for half their lengths and waved to and fro, lending to the body an appearance as if some kind of a pale colored moss was growing from it.

Exostoses not unfrequently occur, either on the shafts of some of the long bones, or upon the surfaces of the flat ones. I have before me a very pretty specimen where one of these bony outgrowths occupies the angle of the carina in the sternum of a specimen of *Eremophila alpestris.* It is nearly as large as a pea, and has a lobulated appearance, jutting forwards.

Aneurismal tumors are sometimes to be seen; the sacs have the appearance of having existed for some space of time—in a few instances.

Muscular atrophy, as far as my observations go, is of rather rare occurrence, although I have seen one good example in the muscles of the lower extremities of a specimen of *Sturnella magna.* There was no apparent cause for it upon *post mortem.* The bird was very loath to take wing, and was killed on the ground, where his locomotion seemed good.

The results of injuries and gun-shot wounds present many examples of interest, and objects for study, if anything, still more engaging. A few days ago I secured a female specimen of *Circus cyaneus* var. *hudsonius,* the horny integuments of whose feet were the sites of many warty excrescences, having the color and general appearances of the parts they occupied. These bodies ranged in size from a duck shot to a small hazel nut. My diagnosis was materially assisted in this case by finding a cactus thorn protruding a little beyond the surface of one or two of the warts, and this foreign body formed the nucleus of all of them.

They were undoubtedly driven forcibly into the feet of this bird, when it seized small mammals among the cactus beds, where they usually burrow for protection. One of the best unions, after gun-shot fracture, I ever had the pleasure of examining (the specimen is now in the Army Medical Museum), occurred, in the upper third of the humerus, in a specimen of *Mergus serrator*, that I secured several months ago. Taking into consideration the fact that this bird is a vigorous diver, and one of no mean powers of flight, the result, if we may so call it, was an excellent one—there being scarcely any deformity—and the member was as serviceable as ever.

I have seen and possess specimens of many other interesting cases, but their description would extend this paper far beyond the limits. The best examples, and those perhaps worthy at least of a mention, consist of a case of non-union in the palatines of *Anas boschus*, a depressed fracture in the cranium of *Corvus americanus*, gunshot injuries resulting in recovery of the brain in Spheotyto and others.

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THE BRAIN OF THE LOCUST.[1]

BY A. S. PACKARD, JR.

IN order to appreciate the habits, migratory, reproductive, &c., of the locust, and to learn something of its general intelligence as an insect and as compared with other insects, it is necessary for us to study with a good deal of care, the organ of the locust's *mind*, *i.e.*, its nervous system, comprising its nervous centers and the nerves arising from them.

The Nervous System in General.—The nervous system of the locust consists of a series of nerve centers or *ganglia*, connected by nervous cords called *commissures*. There are ten of these ganglia in the locust, *i. e.*, two in the head, the first and largest of which is called the "*brain*;" three ganglia in the thorax, and five in the hind-body or abdomen. The brain is situated in the upper part of the head, resting upon the gullet or œsophagus, whence its true name *supraœsophageal ganglion*. (Plate I, Fig. I.) The succeeding nerve-center is situated in the lower part of the head,

[1] Adapted for the NATURALIST from the Second Report of the U. S. Entomological Commission, 1880. We are indebted to the Commission for permission to have an edition of five plates struck off from the lithographic stones at the expense of the publishers.

behind the mouth and under the œsophagus, hence it is called the *subœsophageal ganglion.* (Plate 1, Fig. 5.) The brain really is a double ganglion, being composed of two hemispheres, each hemisphere being a single ganglion or nerve-center; all the succeeding ganglia are also double ganglia; but for convenience we will call the "brain," and each of the succeeding nerve-centers a *ganglion.* Each side of the brain contracts, and then swells out into a rounded portion next to the eye, called the *optic ganglion.* (Pl. 1, Fig. 1.) From this optic ganglion the optic fibers proceed to the facets of the eye. The optic ganglion connects with the brain by the large optic nerve. There are, then, two *optic nerves,* besides three slender nerves *(ocellar nerves)* sent to each of the three *ocelli* or simple eyes; moreover, a nerve is sent to each of the antennæ, and are hence called the *antennal* nerves. The relations of the brain to the head, and to the succeeding ganglion, and the origins of the nerves distributed to the eyes, antennæ and ocelli, as well as of the nerves sent to the jaws, etc., are clearly seen in the figures on Plate 1.

On the other hand the mouth parts, *i. e.*, the jaws *(mandibles)* and accessory jaws (first and second *maxillæ,* the latter called the *labium* or under lip) are each supplied by a pair of nerves, called respectively the *mandibular, maxillary* and *labial* nerves. These three pairs of nerves arise from the subœsophageal ganglion. (See Pl. 1, Fig. 2, g^2.)

The Brain of Insects as distinguished from the Brain of Vertebrates.—The "brain," or supraœsophageal ganglion is, as we shall see, a much more complicated organ than any of the succeeding ganglia, having important parts which are wanting in all the others, hence it is *par excellence* nearer to our idea of a brain than any of the other nervous centers. It should be remembered, however, that the word, "brain" is applied to this compound ganglion simply by courtesy and as a matter of convenience, as it does not correspond to the brain of a vertebrate animal, the brain of the horse or man being composed of several distinct pairs of ganglia. Moreover, the brain and nervous cord of the fish or man are fundamentally different, or not homologous with those of the lower or invertebrate animals, though the nervous system of the insects and Crustacea present greater analogies to that of the vertebrates than any other of the lower animals, with the exception, perhaps, of the cuttlefish. The nervous cord of

E. Burgess del. A. Meisel lith. Boston.

THE BRAIN OF THE LOCUST.

the insect consists of a chain of ganglia connected by nerves or commissures, while the spinal cord of the fish or man is essentially "a double and fused series of nerve-centers." Moreover, if the vertebrate cord is cut through, a section shows that it consists of two kinds of substances or tissues, called the "gray" and "white" substance. The gray matter is situated in the center, and consists largely of nerve or so-called "ganglion cells," while the external white matter of the brain or cord is composed of a mass of nerve fibers. Now, in the nervous system of insects there is nothing to compare with these substances, but the ganglia, on the contrary, as we shall see farther on, consist primarily of an external layer of ganglion cells, whose fibers pass in to form a central fibrous mass or net-work, the meshes of which are filled with a fine granulated nerve substance, the nature of which is not clearly understood. Moreover, the entire brain of an insect is white, as are all the ganglia.

A ganglion in its simplest form is a little rounded mass, or nodule, of ganglion cells, with fibers leading from them: such cells are represented by Fig. 3*a*—3*e*, on Plate III. Now when the fibers lead in from the sensitive hairs on the crest of the insect, or from the antennæ, or the eyes or ears, and end in separate masses or lobes, which are modified ganglia, such ganglia are regarded as "sensory ganglia," and the nerves leading in from them are called ingoing or "afferent nerves," while the ganglia which give rise to the outgoing or "efferent" nerves, *i. e.*, those going to the muscles of the wings, legs, &c., are called "motor ganglia."

It should be borne in mind as the result of recent studies by several observers, as Leydig, Flögel, Dietl and Newton, that the subœsophageal ganglion, or "brain," of the insect is much more complex than any other ganglion, consisting more exclusively both of sensory as well as motor ganglia and their nerves. But it should also be understood that the subœsophageal ganglion also receives nerves of special sense, situated possibly on the palpi, and possibly on the tongue, at least the latter is the case with the bee; hence, this ganglion is probably complex, consisting of sensory and motor ganglia. The third thoracic ganglion is also, without doubt, a complex one, as in the locusts the auditory nerves pass into it from the ears, which are situated at the base of the abdomen. But in the green grasshoppers, such as the katydids and their allies, whose ears are situated in their fore legs, the first thoracic ganglion is a complex one. In the cockroach and in the *Leptis* (Chrysopila), a common fly, the caudal appendages bear what are probably olfactory organs, and as these parts are undoubtedly supplied from the last abdominal ganglion, this is probably composed of sensory and motor ganglia; so that we have in the ganglionated cord of insects a series of brains, as it were, running from head to tail, and thus in a still stronger sense than in vertebrates the entire nervous system, and not the brain alone, is the organ of the *mind,* or psychological endowments, of the insect.

We will now proceed to examine the brain of the adult *Caloptenus spretus*, and compare it with that of other insects; then study its development in the embryo, and finally examine the changes it undergoes in the larva and pupal stages before attaining the fully developed structure of the adult locust.

Histological Elements of the Brain.—The brain is histologically or structurally divided into two kinds of tissue or cellular elements.

1. An outer, slightly darker, usually pale-grayish white portion is made up of "cortical cells," or "ganglion cells." (Pl. III., Fig. 3, *a, b, c, d.)*

This outer loose cellular envelope of the brain consists of large and small ganglion cells. Where the tissue consists of small ganglion cells, it is naturally from the denser arrangement of the smaller cells, which are packed closer together, rather darker than in those regions where the tissue consists of the more loosely disposed, large ganglion cells.

A. The large ganglion cells (Pl. III., Fig. 3, 3 *a*, 3 *b*, 3 *c*, 3 *d*, *e)* are oval, and send off usually a single nerve fiber; they have a thin fibrous cell wall, and the contents are finely granular. The nucleus is very large, often one-half the diameter of the entire cell, and is composed of large round refractive granules, usually concealing the nucleolus (the granules are much larger and fewer in number and the nucleolus is less distinct than in the brain of Limulus, the king crab). These large ganglion cells are most abundant and largest on each side of the upper furrow, and in front of the "central body," also at the bottom of the lower furrow, and along the exterior of the optic and antennal lobes, and along the commissural lobes.

B. The small ganglion cells apparently differ chiefly in size from the large ones, and are most numerous in the front swelling of each hemisphere; they surround and fill the calices of the mushroom bodies, and they extend along each optic nerve and form a large proportion of each optic ganglion, especially the layer next to the retina of the eye, though they are replaced by large ganglion cells at the junction of the fibrous part of the optic nerve with the dilated granular portion. The brain is surrounded more or less completely by the connective tissue cells belonging to the mesoderm or middle germ layer, and which are sometimes liable to be confounded with the ganglion cells, as they stain the same tint with carmine. It should be borne in mind that the nervous system, ganglia and nerves, originate from the tegumental or exodermal layer.

II. The medullary or inner part of the brain consists of matter which remains white or unstained after the preparation has remained thoroughly exposed to the action of the carmine. It consists of minute granules and interlacing fibers. The latter often forms a fine irregular net-work inclosing masses of finely granulated nerve matter.

In the antennal and commissural lobes is a third kind of matter, in addition to the granular and fibrous substances, which forms irregularly rounded masses, cream-colored in picro-carmine preparations, and which stain dark with osmic acid. This is called by Dietl "*marksubstanz*," and is described by Newton as "a peculiar arrangement of nervous matter, which appears sometimes as fine fibrillæ, with an axial arrangement, sometimes as a very fine net-work of different thicknesses, and sometimes as thin lamellæ, or altogether homogeneous."

It is to be noticed that this central unstained portion contains few, if any, ganglion cells, and it is most probable that the fibers of which it is composed originate from the cortical ganglion cells. At one or two points at Fig. 3, Pl. III, I have seen the fibers passing in from ganglion cells towards the middle of the brain. In the horseshoe crab (Limulus), owing to the simple structure of the brain, it is evident that the optic and ocellar nerves and posterior commissures originate from the large ganglion cells which in this animal are situated in or near the center of the brain. In the last abdominal ganglion also the fibers arising from the peripheral ganglion cells can very plainly be seen passing in towards the center of the ganglion and mingling with the fibers forming it. Hence, in all probability the fibrous mass of the central part of the brain mostly originates from the peripheral or cortical ganglion cells.

To briefly describe the brain of the locust, it is a modified ganglion, but structurally entirely different from and far more complicated than the other ganglia of the nervous system. It possesses a "central body," and in each hemisphere a "mushroom body," optic lobe, and optic ganglion, and olfactory lobe, with their connecting and commissural nerve fibers, not found in the other ganglia. In the succeeding ganglia the lobes are, in general, motor; the fibers composing the œsophageal commissures, and which arise from the œsophageal commissural lobes, extend not only to the subœsophageal ganglion, but pass along through the succeeding ganglia to the last pair of abdominal nerve centers.[1] Since, then, there is a direct continuity in the fibers forming the two main longitudinal commissures of the nervous cord, and which originate in the brain, it seems to follow that the movements of the body are in large part directed or coördinated by the brain.[2] Still, however, a second brain, so to

[1] We have seen that the two great longitudinal commissures pass directly from the the brain into and then pass backward from the subœsophageal ganglion, but beyond that point we have not traced their course, as it is generally supposed that they extend uninterruptedly to the last abdominal ganglia. This has indeed been shown to be the case by Michels, in his admirable treatise on the nervous system of a beetle (Oryctes) in Siebold and Kölliker's Zeitschrift für wissen. Zoologie, Band 34, Heft. 4, 1880. Michels states that each commissure is formed of three parallel bundles of elementary nerve fibers, which pass continuously from one end of the ventral or nervous cord to the other. "The commissures take their origin neither out of a central punctsubstanz (or marksubstanz), nor from the peripheral ganglion cells of the several ganglia, but are mere continuations of the longitudinal fibers which decrease posteriorly in thickness, and extend anteriorly through the commissures forming the œsophageal ring to the brain."

[2] The following extract from Newton's paper shows, however, that the infra or subœsophageal ganglion, according to Faivre, has the power of coördinating the movements of the body; still it seems to us that the brain may be primarily concerned in the exercise of this power, as the nerves from the subœsophageal ganglion supply only the mouth parts. "The physiological experiments of Faivre, in 1857 (Ann. J. Sci. Nat., Tom. viii. p. 245), upon the brain of Dytiscus in relation to locomotion, are of very considerable interest, showing, as they appear to do, that the power of coördinating the movements of the body is lodged in the infraœsophageal ganglion. And such being the case, both the upper and lower pairs of ganglia ought to be regarded as forming parts of the insect's brain." Quart. Jour. Micr. Sc., 1879, p. 342.

speak, is found in the third thoracic ganglion of the locust, which receives the auditory nerves from the ears situated in the base of the abdomen; or in the first thoracic ganglion of the green grasshoppers (katydids, &c.), whose ears are in their fore legs; while even the last abdominal ganglion in the cockroach and mole cricket is, so to speak, a secondary brain, since it receives sensory nerves from the caudal stylets which are provided with sense organs.

Description of the sections of the Brain.[1]—We will now describe the sections upon which the subsequent account of the brain is founded. The sections, unless otherwise stated, are *frontal*, *i. e.*, cut transversely across the face from before backwards; in cutting thus through the head, twelve sections were made before the front part of the brain was touched, the thirteenth grazing the front of the brain. Section fourteen passed through the anterior part of both *calices*, but did not touch the stalk of the *mushroom body* (these terms will be explained farther on). It passed through the central region of each hemisphere, including the front part of the *trabeculæ* or base of the stalk of the mushroom body. The section passed through the commissural lobes, the lower third being composed of the ganglion cells, but the substance of the commissure itself is filled with the ball-like masses of "marksubstanz." The commissures to the subœsophageal ganglion were not touched, and do not appear in the section, since they arise from the back of the brain.

In section 15 no additional organs are exposed. In section 16 (Pl. II, Fig. 1) the trabeculæ are seen, when magnified 225 diameters, to be composed of ascending fibers, which form the base or origin of the double stalk of the mushroom body.

Section 17 (Pl. II, Fig. 2) is the most important of all the sections, as the entire mushroom body and the central body are cut through, together with the antennal lobes, and the commissural lobes, and also the origin of the optic nerves.

In section 18 (Pl. II, Fig. 4) the double nature of the stalk of the mushroom body is seen; the optic lobes are now well marked, and the razor grazed the back of the commissural lobes, as well as the inner side of the optic ganglion. The section passed behind the trabeculæ and the base of the stalk and through the back of

[1] We are indebted to Mr. Norman N. Mason, of Providence, R. I., for cutting and mounting the sections used in making the observations here recorded.

the central body. The calices are each seen to be so furrowed and uneven as to appear in the section as two separate portions. Two important nerves (Pl. II, Fig. 4, *p. a. n.*) are seen to arise from the commissural lobes, and to pass upwards, ending on each side of the upper furrow, near the origin of what we think are possibly the ocellar nerves *(o. c. n. ?)*.

Section 19 (Pl. III, Fig. 1) passed through the back of the brain (compare Fig. 4, of the same plate, which represents a vertical or longitudinal section of the brain), through the œsophageal commissures, and the back edge of the calices, while the antennal lobes and a part of the optic lobes are well seen in the section. A transverse commissural nerve *(t c n)* connects the two antennal lobes, and the commissural nerves are seen to cross at the bottom of the furrow.

Section 20 (Pl. III, Fig. 2), which passes through the extreme back of the brain, shows in this plane four transverse bundles of nerve fibers connecting the two hemispheres, *i. e.*, the inferior *(inf. n.)*, two median (m. n.) and a superior nerve *(sup. n.)*. In this section the relations of the optic ganglion and eye to the brain are clearly seen, the optic ganglion being situated in the posterior region of the brain. It will also be seen that the two hemispheres are at this point only connected anteriorly.

In sections 22, 23 and 24 the brain nearly disappeared, and only the optic ganglia were cut through by the microtome, affording instructive sections of the three lenticular masses of white unstained granulo-fibrous substance surrounded by ganglion cells.

Internal Topography of the Brain.—Disregarding the envelope of cortical ganglionic cells, though they are evidently of primary importance in the physiology of the insect's brain, we will now describe the internal topography of the brain. It consists primarily of an irregular net-work of nerve-fibers, inclosing masses of granulated nerve matter. This mass is divided into a number of separate areas or lobes, of which the "central body" *(corpus centrale* of Flögel and Newton) is single and situated between or in the median line of the two hemispheres. There is also a primitive superior and inferior central region, better shown, however, in the brain of the embryo and larval locust than in the adult. Besides these areas are the rounded masses or "lobes," *i. e.*, the optic, antennal, or olfactory and commissural lobes; the optic nerves arising from the optic lobes, the antennal nerves from the

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antennal lobes, and the commissures surrounding the œsophagus and connecting the brain with the subœsophageal ganglion, and which arise from the commissural lobes. Finally a "mushroom body" is situated in the upper and central part of each hemisphere.

The Central Body.—This is the only single or unpaired organ in the brain. It is best seen in section 17 (Pl. II, Fig. 2), which also passes through the optic and antennal lobes and the trabeculæ and mushroom bodies. This singular organ is apparently present in all winged insects, though differing somewhat in structure in different insects. It is, as seen in Pl. II, Fig. 2, situated in the same plane as the peduncle and in the same plane as the center of the entire mushroom body, and rests upon the inner sides of the trabeculæ. Section 16 does not pass through it, though the next section, which is $\frac{1}{500}$ inch thick, passes through its middle. Section 18 (Fig. 4) passes through its back, while the next section does not include any part of it; hence its antero-posterior diameter is slightly over $\frac{1}{500}$ of an inch. It is about twice as broad as high, and thus is a small body, though from the universality of its occurrence in winged insects, it may be one of considerable importance.

It is surrounded by a dense net-work of fibers containing a few small ganglionic cells, the fibers in front continuous with those near the bottom of the frontal median furrow and connecting the two optic lobes. Posteriorly the fibers apparently are not continuous with those of the trabeculæ; hence the central body appears to be quite isolated from the rest of the brain. Its substance, when magnified 400 diameters, appears to be a white granular matter like the adjoining parts of the brain. It is divided into two parts, the superior and inferior, the former part constituting the larger part of the body. The inferior portion is separated by fibers from the superior; it contains numerous nucleated spherical cells situated either irregularly or perhaps primarily (see Pl. IV, Fig. 3, of the pupa) in two rows when fewer in number than in the adult. The superior and larger division of the central body contains two series of what we may call *unicellular bodies*, sixteen in a series. The lower series are spherical or slightly elongated, and rest in the fibrous partition or septum, forming the floor of the superior division of the central body. The upper row of bodies are cylindrical, and about three or four times as long as thick. They are separated by thin fibrous septa. Pl. IV, Fig. 2, represents the central body enlarged 225 diameters. When we examine the central body in an earlier stage, *i. e.*, the second pupal (Pl. IV, Fig. 3), we see that the body is covered above by a stratum of nucleated ganglion cells continuous with those next to the bottom of the upper furrow; and that the fibrous septum between the upper and lower division also contains small cells. These cells disappear in the adult, and evidently give rise to the fibers which take their place. It will also be seen that the "unicellular bodies" are shorter, more cell-like than in the adult; hence they seem to be modified ganglion cells, which have at an early date lost their nucleus and nucleolus. My observations on the central body of the locust agree in the main with those of Newton (compare his Fig. 9). His drawings are not especially clear and definite, but the differences appear to be unimportant. There are perhaps two (16 instead of "12 or 14") more cellular bodies in the locust than in the cockroach. Unfortunately my sections of the brain of the cockroach do not show the central body. Dietl states that the central body is a "median commissural system." This description we would accept in a modified sense. We have shown that the unicellular bodies and the cells beneath them were once like the ganglion cells, but that they have lost their nuclei and nucleoli; hence the functions of the central body must be unlike that of an ordinary commissural lobe. Flögel states that the number of "sections," or what I call unicellular bodies, is eight; we have counted sixteen. Both Flögel and Newton appear to regard these bodies as simply spaces or sections between fibrous partitions; but it would appear that these sections are really modified cells, and that the fibrous septa are possibly the cell-walls, somewhat modified.

The Mushroom Bodies.—These curious organs have attracted a good deal of attention from writers on the brain of insects. Dujardin, in 1850, first drew attention to them. His memoir we have not at hand to refer to, but as stated by Newton[1]—

"Dujardin pointed out that in some insects there were to be seen upon the upper part of the brain certain convoluted portions which he compared to the convolutions of the mammalian brain, and, inasmuch as they seemed to be more developed in those insects which are remarkable for their intelligence, such as ants,

[1] On the Brain of the Cockroach. By E. T. Newton. Quart. Journ. Microscopical Science, July, 1879, pp. 341, 342.

bees, wasps, &c., he seemed to think the intelligence of insects stood in direct relationship to the development of these bodies. The form of these structures is described by the same author as being, when fully developed, as in the bee, like a pair of disks upon each side, each disk being folded together and bent downwards before and behind, its border being thickened and the inner portion radiated. By very careful dissection he found these bodies to be connected on each side with a short pedicle, which bifurcates below to end in two tubercles. One of these tubercles is directed towards the middle line, and approaches but does not touch the corresponding process of the opposite side. The second tubercle is directed forwards, and is in close relation to the front wall of the head, being only covered by the pia mater (neurilemma). These convoluted bodies and the stalks upon which they are mounted are compared by Dujardin to certain kinds of mushrooms, and this idea has been retained by more recent writers on the subject."

The form of the mushroom body is much more complicated in the bee or ant than in insects of other orders. In the cockroach and in other Orthoptera, notably the locust, the four divisions of the calices are united into two; while the structure of the calyx in the cockroach is quite different from that of the locust. Mr. Newton, is his description, notwithstanding Dujardin's statement, appears to practically limit the term "mushroom body" to the cap or calyx on the end of the stalk. In the following description we apply the term "mushroom body" to the entire structure, including the base or trabecula, the double stalk, and the cap or calyx.

So far as we have been able to observe, the double stalk of the mushroom body rests on a rounded mass of granulo-fibrous nerve matter; this rounded mass or base of the column is called the *trabecula* (Pl. II., Fig. 2, *trab.).* The two trabeculæ (one in each hemisphere) are much more widely separated (in my sections) than in the cockroach or in those insects studied by Flögel; the space between them being filled by a loose cellular mass containing small nucleated cells. The thickness of each trabecula is greater than that of the double stalk. Section 14 passes through the outer or anterior edge of the trabecula, and also through the calices at some distance from the edge. Section 18 (Fig. 4) does not include it, though showing well the mushroom body, with the exception of the base of the double stalk. It follows that the thickness of the trabecula is about $\frac{3}{500}$ of an inch.

The substance of the trabecula is seen to be minutely fibrous under a power of 725 diameters, with masses of granules among the fibers which are much finer than in the optic or antennal lobes. At the point passed through by section 17 the trabeculæ appear to have no connection with the stalk, but the latter appear to stop abruptly just before reaching it, the envelope of ganglionic cells and fibers surrounding the trabeculæ being interposed between the base of the stalk and the trabecula. (This does not preclude the fact that the stalk does not arise from the trabecula, though there are no signs of it in this section; for it clearly appears to thus arise in the drawings and descriptions of Dietl, Flögel, and Newton.)

The structure of the trabeculæ in the locust, judging from our sections, appears to be more complex than would be inferred from the observations of the other anatomists just mentioned. Section 17 (Pl. II., Fig. 2, *trab.)* passes through the middle of each of these bodies, and it then appears that there are four bundles of nerve-fibers passing out of each body. A bundle of transverse nerve-fibers (Fig. 2, *t. c. n.* and Fig. 3) passes along under the central body, directly through the middle of the trabeculæ, and anastomoses with the fibrous envelope of each trabecula. In front of this transverse intra-trabecular nerve is a small short ascending bundle of fibers (Fig. 3 *a. t. n.)* which passes next to the pedicel, but does not apparently form a part of it, but anastomoses with the fibers on each side of the central body. Below, the fibers pass downward and outward to apparently connect with the fibrous envelope of the trabecula. Another short bundle passes out from the trabecula obliquely towards the central body and anastomoses with the fibrous envelope of the central body.

Below, but in the same plane, is another transverse bundle of fibers (Fig. 3, *l. t. n.)*, which is slightly curved and on the left side its fibers are distinctly seen to enter the trabecula. This lower intrabecular nerve, as we may call it, connects with three vertical short nerves arising from near the edge of the lower furrow between the hemispheres of the brain. Of these, the central one *(centr. n.)* is in the median line of the brain, and the lateral ones *(lat. n.)* are on each side. There would thus seem to be a direct double nervous communication between the two trabeculæ, and with the fibers surrounding the central body, and hence with the rest of the brain. This seems to be opposed to the statement of Newton that the trabeculæ, and the mushroom bodies in general, have no

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nervous connection with the rest of the brain. This section also clearly indicates the origin of the optic nerve, which passes *behind* the stalk of the mushroom body, and also the relation of the fibers of the stalk to the calices, as they appear to penetrate far into the interior of the body of each calyx.

The Double Stalk (cauliculus and *peduncle).*—These names are applied to the larger and smaller divisions of the stalk of the "mushroom body." They are represented in the eighteenth section (Fig. 4) where the outer part of the stalk *(cauliculus)* supports the outer calyx, and the inner slenderer column of fibers supports or ends in the inner division of the calyx. These two bundles of fibers are somewhat curved, but as they do not appear in sections 16 and 19, must be less than $\frac{2}{500}$ of an inch thick. Their fibers are seen to penetrate deeply into the base of the calices, and thus to directly communicate with the fine granular substance of the calices.

The Calices.—The cups of the mushroom bodies in the locust differ decidedly in form from those of the cockroach, and this part of the mushroom body is more variable in form in the different orders of insects than any of the other parts of the brain. It is nearly obsolete, or, as Flögel states, "not more than rudimentary" in hemipterous insects (notably *Syromastes)*, and is less completely developed in many smaller moths, beetles, and flies, as well as Neuroptera *(Æschna)*, according to Flögel, than in the larger moths, in the Orthoptera, and especially in the Hymenoptera, where it is well developed. We have been unable to find it as yet in the brain of myriopods or of the spider. In the locust each body is more or less rounded and rudely saucer-like rather than cup-like, with the rim very thick; the hollow of the cup, if it be hollow, is small in proportion to the thickness of the saucer-like cup. The diameter of a calyx is about $\frac{7}{500}$. The anterior edge reaches to the front edge of each hemisphere of the brain, but does not extend to the back part of the brain. The relations in a vertical, *i. e.*, longitudinal section of the mushroom body to the rest of the brain are seen in Pl. II, Fig. 8 *a*. It thus appears that the double stalk is situated near the center of the brain, and that the cup projects far forward, but posteriorly does not extend behind the antennal lobes or the commissures. In section 18 (Fig. 4) the calices are seen to be double, the outer *(o. cal.)* attached to the cauliculus *(cau.)* and the inner arising from the peduncle.

Fig. 8 *a* gives an idea of two calices and their mode of attachment to the stalk. The peduncle (if we interpret that division of the stalk aright) sub-divides, sending a thick bundle of fibers to each calyx, ending abruptly in the hollow of the calyx. The substance of the calices is finely granular, with some coarse granules, and apparently short scattered irregular fibers. The structure of the calices of the locust appears to be more homogeneous than that of the cockroach, judging by our sections of the latter. Owing to different treatment by reagents the dark masses described by Newton as existing in the cockroach were not so clearly shown in my sections ($\frac{1}{1000}$ inch thick) as in those made by Mr. Newton. The substance of the calices when examined under a power of 725 diameters is much the same both in the cockroach and the locust, the dark bodies not appearing in either. The form of the calices is very different in the cockroach, the calices being truly cup-like, the disk being deeply folded, and the edges of each cup being thin compared with those of the locust.

The Optic Lobes.—As seen in section 19 (Pl. III, Fig. 1 *op. l.*) these bodies are larger than the antennal lobes, and consist of numerous irregular small bundles of fibers besides those composing the optic nerve, the interspaces being filled with fine granular nerve substance. The optic nerve is much larger at the outer edge of the lobe before passing into the optic ganglion, the fibers still being immersed in the finely granular nervous substance.

The Optic Ganglion.—This is situated at the back of the brain, and is a large rounded mass of white fine granular nervous matter, enveloped in very numerous but small ganglion cells, which stain dark red by carmine, the granular matter remaining unstained by the picrocarmine. The granular or white portion is subdivided into three rudely lens-shaped masses (see Pl. V, Fig. 1), the one nearest the eye being much the largest.

The Antennal or Olfactory Lobes.—Section 19. (Pl. III., Fig. 1, *ant. l.*). These are smaller than the optic lobes, though in section 19 they appear larger. They give rise to the antennal nerve, and as the locust carries its ears at the base of the abdomen, the auditory nerves entering the third thoracic ganglion, reasoning by exclusion the antennæ in Orthoptera must be organs of smell, and the lobes and nerves to the antennæ are consequently olfactory. This is the opinion of some recent writers, notably Hauser.[1]

[1] Physiologische und histiologische Untersuchungen über das Geruchsorgan der Insekten. Siebold und Kölliker's Zeitschrift für Wissen. Zoologie, Bd. 34, Heft. 3.

The lobes are, as described by the other observers, filled with ball-like yellowish masses, which stain dark by osmic acid, much as in the commissural lobes. Nerve fibers are seen in section 19 to pass from one antennal lobe to the other in the rear of the central body and of the trabeculæ, while other nerve fibers are seen to pass into the optic lobes and the commissural lobes. This system of intra-lobal nerves demonstrates that there is a nervous intercommunication between these cerebral lobes and the ganglionic chain of the entire body.

The Commissural Lobes.—From these large bodies proceed the two great longitudinal commissural nerves, forming the connecting threads of the nervous cord, and which extend from the brain to the last abdominal ganglion, passing through the intermediate nerve centers. The lobes are filled with ball-like masses, of the same general appearance as in the antennal lobes, but more distinct and numerous.

Comparison of the Brain of the Locust with that of other insects.—Newton rightly regards the cockroach's brain as a generalized form of brain, which may serve as a standard of comparison. The cockroach is geologically one of the oldest of insects; its external and internal structure is on a generalized plan, and the brain conforms to this order of things. Our knowledge of the cockroach's brain is derived from the photographs and account of Flögel, and Newton's excellent descriptions and figures, supplemented by two sets of sections made for us by Mr. Mason, but which unfortunately, are quite defective as regards the trabeculæ and stalk of the mushroom body. The shape of the calices of the cockroach, as already stated, is very different from that of these bodies in the locust, and indeed from any other insect yet examined, the cup being very deep and the sides thin; but the intimate structure seems nearly the same in the two insects.

In the cockroach the antennal and commissural lobes are of much looser texture, with large and numerous ball-like masses *(ballensubstanz)*; these are, when magnified 400 diameters, not only larger, but more distinct from the rest of the nervous matter of the lobe than in the locust. When magnified, as mentioned, the ball-like masses appear to be simple masses of finely granular nervous matter, with darker granules, much like the rest of the granular portions of the brain, but with coarser granular masses than in the substance of the optic lobes. These ball-like masses are surrounded by a lose net-work of anastomosing nerve fibers continuous with those of the antennal nerve, and with scattered nucleated cells, which become very numerous in the antennal nerve. The nerve fibers are stained reddish by the picrocarmine.

Turning now to other orthopterous insects, Flögel mentions Acrydium, but states that he had no serviceable preparations, and after describing the brain of Forficula, the ear-wig, says: " As I observe in Acrydium, the cells and fibers in this animal are especially large, and these objects invite further investigation." Flögel's photograph and description of the brain of Forficula, a representative of an aberrant family of Orthoptera, and Dietl's beautiful figures and descriptions of the brain of the molecricket *(Gryllotalpa vulgaris)* and the cricket *(Acheta campestris)*, show that the orthopterous brain, judging from these representative forms, is constructed on a common type, the most variable part being the calices of the mushroom body.

From these facts we should judge that, on the whole, the locusts were as highly endowed intellectually as any other insects, with the exception of the ants, bees, or wasps, *i. e.*, the social species; for in these forms the insect brain reaches its highest development, as we might expect from the wonderful instincts and power of reasoning exhibited by these social species; while in a number of insects the brain is less developed than in the locust. It would thus appear that, as in the vertebrates, there are different grades of brain-development, considerable extremes existing in the same sub-class of insects, as for example, in the same sub-class of mammals.

The brain of the bee and ant, as shown by Dujardin and demonstrated by Dietl and Flögel, is constructed on a higher, more complicated type than in the other winged insects, owing to the much greater complexity of the folds of the calices or folded disk-like bodies capping the double stalk of this organ.

[*To be concluded.*]

LETTERING OF THE FIGURES ON PLATES I—V.

centr. b., central body.
trab., trabecula.
cau., cauliculus.
ped., peduncle.
o. cal., outer calyx, or cup.
i. cal., inner calyx.
op. l., optic lobe.
op. n., optic nerve.
ant. l., antennal lobe.
ant. n., antennal nerve.
œ. com. l., œsophageal commissural lobe.
œ. com. n., œsophageal commissural nerve.
œ. c., œsophageal commissural nerve.
lbr. n., nerve to labrum.
l. g. c., large ganglion cells.
s. g. c., small ganglion cells.
opt. gang., optic ganglion.
sg. n., sympathetic nerve.
t. n., transverse nerve.
u. intr. n., upper intratrabecular nerve.
l. intr. n., lower intratrabecular nerve.
ln., nerve to labium.
fg., frontal ganglion.
psg., posterior sympathetic ganglion.
lat. n., lateral nerve.
centr. n., central nerve.
obl. tr. n., oblique trabecular nerve.
a. t. n., ascending trabecular nerve.
m. n., two median commissural nerves.
sup. n., superior commissural nerve.
inf. n., inferior commissural nerve.
tr., trachea.
up. l., upper cerebral lobe of embryo.
low. l., lower cerebral lobe of embryo.
gang. c., ganglion cells.
gran., granules of the central nervous matter.
œs., œsophagus.
int., integument.
o. n., ocellar nerve; *oc.*, ocellus.
n. c., ventral nervous cord.
ncl., nucleolus.
lbr., labrum.
md., mandible.
lm., labium.
cl., clypeus.

EXPLANATION OF PLATE I.

FIG. 1.—Front view of the brain of *Caloptenus femur-rubrum.*

FIG. 2.—Side view of the same.

FIG. 3.—Side view of the head showing the relation of the brain to the mouth (*m*) and œsophagus (*æ*) and walls of the head.

FIG. 4.—The brain as seen from above, and the three ocelli.

FIG. 5.—The subœsophageal ganglion seen from above. Drawn by E. Burgess.

DESCRIPTION OF PLATE II.

FIG. 1.—Frontal section 16, through the front of the brain of adult *Caloptenus spretus;* × ½ inch objective, A. eye-piece.

FIG. 2.—Section 17, showing the central body (*centr. b.*) and mushroom body, optic and antennal lobes, and commissural lobes; × ½ A.

FIG. 3.—Enlarged view of the trabecula and its nerves, of the mushroom body, its calices and stalk, and the origin of the optic nerves; × ⅕ A., 225 diameters.

FIG. 4.—Section 18, passing through the back of the central body, showing the double nature of the stalk of the mushroom body, and passing through the back of the commissural lobes and behind the trabecula and the base of the stalk; × ½ A. Are *oc. n. ?* the origins of the ocellar nerves?

FIG. 5.—Vertical (longitudinal) section through one of the hemispheres, showing the origin of the commissural and antennal nerves and the optic lobe.

FIG. 6.—Longitudinal section through the brain and subœsophageal ganglion (× 50 diameters), showing the two portions of the calyx, the antennal lobe, and in the subœsophageal ganglion the three lobes giving off respectively the mandibular, maxillary, and labial nerves.

FIG. 7.—Longitudinal section through the optic ganglion and the eye; × 50 diameters.

FIG. 8.—Longitudinal section through the brain, showing the calyx, antennal lobes, and commissural lobes; × 50 diameters.

FIG. 8 *a*.—Enlarged view of Fig. 8 (× ½ B.), showing the relations in a longitudinal section of the calyx to the stalk, although the direct connection of the stalk with the calyx is not seen in this section.

DESCRIPTION OF PLATE III.

FIG. 1.—Section 19 (× ½ A), passing through the back of the brain, showing the posterior edge of the calices and antennal lobes and œsophageal commissural nerves and optic nerve. *tr.*, small tracheæ.

FIG. 2.—Section 20, passing through the back of the brain, showing the relation of the optic nerve to the optic ganglion and eye; the cornea, cones, rods and retina of the eye are shown; × ½ A. *sup. n.*, superior, *m. n.*, median, and *inf. n.*, inferior commissural nerves connecting the hemispheres.

FIG. 3.—Enlarged view of upper part of the stalk and calyx, and the ganglion cells surrounding and filling the latter; × 225 diameters. 3 *a*, *b*, *c*, *d*, different ganglion cells seen from different directions, 3 *c* showing the large nucleus filled with coarse granules, but showing no nucleolus; one, however, is seen in Fig. 3 *b*. *ncl.*; × 725 diameters.

FIG. 4.—Longitudinal section of the brain and subœsophageal ganglion, magnified 50 diameters, showing the relations between the two, and of the origin of the œsophageal commissure from the upper side of each ganglion, *i. e.*, from the back of the brain and the upper side of the subœsophageal ganglion.

FIG. 5.—Enlarged view (× ½ B) of the subœsophageal ganglion of Fig. 6, Pl. x, showing the origin of the commissure to the first thoracic ganglion, and on the under side the three lobes (mandibular, maxillary, and labial), whence the nerves are sent to the mouth-appendages. *mand. l.*, mandibular lobe; *max. l.*, maxillary, and *max. l'.*, 2d maxillary or labial lobe; *com.*, commissure to subœsophageal ganglion.

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EDITORS' TABLE.

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

—— The day is probably not distant when government aid for the protection of agriculturists against injurious plants and animals will be demanded as urgently as for geological, coast and land surveys. Let us glance briefly at the reasons why such aid becomes imperative. Until within three years no special attention had been given by Congress to these subjects; what little had been done by the botanist and entomologist connected with the Department of Agriculture being, from causes beyond their control, too slight to be worthy of mention. What had been done by the Government was much less than the efforts of several States, notably New York, Missouri and Illinois; these States having appropriated sums amounting from $15,000 to $30,000 for the investigation of injurious insects, with results of the greatest and most obvious importance.

Until the formation in 1877 of the U. S. Entomological Commission, not a dollar was ever appropriated by the General Government for the investigation by experts of injurious insects, nor for the study of the rust, smut, mildew and other injurious fungi by which millions of dollars are lost to agriculture. About a year after the establishment of the commission, Professor Riley, the chief of the commission, was appointed Entomologist to the Department of Agriculture, and during the short time he held the position, by his personal efforts obtained from Congress a special appropriation of $5000 to place his Division upon a more practical basis, and also another appropriation of $5000 for the investigation of the cotton worm. The readiness with which these appropriations were granted, shows that Congress appreciates capable effort in applied entomology. The first-mentioned appropriation has since been made annually to the Department, while others have also been made for continuing the cotton worm investigation under the direction of the U. S. Entomological Commission. These appropriations were the immediate result of the labors and example of this Commission and not of the Agricultural Department itself.

Under the Interior Department, from small beginnings, a large and growing branch of applied Zoölogy has grown under the care and unremitting toil of Professor Baird. We refer to the Commission of Fish and Fisheries. Ten years ago the depleted fisheries of the Atlantic coast and the local disputes of the fishermen attracted the attention of Congress, and Professor Baird was appointed a Commissioner to investigate the causes. The first appropriation was $5000, we believe; the one last year ungrudgingly voted by Congress was about $140,000 in the aggregate. It is needless to state that the practical results of these investigations have been immediate and many-fold the amounts appropriated, and the benefits conferred on American biology enormous. It should be said that the value of our fisheries by the census of 1870 was only $11,096,522, though the estimate is only approximative and imperfect.

Turning to our geological surveys; within the last twenty-five years sums aggregating several millions of dollars, in some years over $200,000 per annum, have been wisely appropriated by Congress for the surveys of the public domain. Owing to the fostering spirit shown by Government, American geology stands preëminent, and ranks as high as in the governments of Europe; and yet compared with the agricultural products of the country, the mineral products of the United States are inconsiderable. By the census of 1870 the mineral products of this country amounted to $152,598, 994. This amount is only approximative, as it was impossible to obtain exact returns. But it will be seen that for the interests involved, the Government has been liberal in its appropriations for geological investigations, and it will be the best economy to be still more liberal than in the past.

How much has the General Government expended for our national agriculture, whose products amounted, in 1870, to $2,447,538,658, the returns being in the nature of things far more reliable and exact than in the other departments enumerated? We would answer emphatically that beyond laying out the agricultural grounds and erecting the Department building at Washington, distributing seeds (the larger share of which were of the commonest kinds of flowers and vegetables obtained at bargains of seedsmen), the amounts voted by the Government in this direction have not, in the opinion of agricultural experts, or of others well qualified to judge, been at all commensurate with what ought or should have been voted. We do not deny that considerable good has been accomplished by the Agricultural Department, especially of late, in agricultural chemistry and animal diseases. But absolutely nothing has been accomplished in building up those branches of applied science related to agriculture, in creating trained experts, in the issue of scientific and authoritative reports, bulletins and manuals, in obtaining the coöperation and counsels of experts in different parts of the country, all working together for the benefit of a scientific, or in other words common-sense agriculture.

We would ask if the time is not coming for a practical biological survey of the United States commensurate with the immense interests involved, and on a scale analogous to the geological and coast surveys and the signal bureau? At least cannot a slight beginning be made in this direction?

The average annual loss to the nation from the attacks of injurious plants and insects and other animals, amounts at a moderate calculation to $300,000,000. A large proportion of this loss or waste could, by human means, be saved and added to the national capital. Within a period of four years a few of the Western States suffered a loss of $200,000,000, by the attacks of the Rocky mountain locust. The State of Illinois lost in one year (1864) $73,000,000 by the chinch bug; the annual average loss to the cotton crop is estimated at not less than $15,000,000 or $20,000,000. Such figures and estimates could be multiplied.

With a proper reorganization or enlargement of the Agricultural Department, under the direction of a commissioner of intelligence and scientific attainments, these scientific investigations might be begun and carried on, or if this department is hopelessly fated to go on as in the past, the work might be superintended by the Smithsonian Institution, if not carried on under the Interior Department. However this may be, there is urgent need of intelligent extended botanical and entomological investigations. In time, appropriations for such work would not be needed: the Government need only to foster such investigations, give them a start, and when the work is well advanced, leave it to State and individual action. We leave to another occasion the needs of an investigation of disease-germs, plant-fungi, in connection with rust, smut and mildew, and of cattle diseases, and would say a word in reference to applied entomology. This work cannot be done by one or several entomologists confined the year around to the Agricultural Department at Washington, where there are no extensive field or garden crops and forests. There might be formed a national board of entomologists, who should investigate cotton, wheat and corn insects, those infesting field and grass crops, and our forest and shade trees. They should not all be required to live at Washington, but work where the material is at hand; they should, therefore, divide the subject among themselves, prepare special bulletins, final reports and manuals for the diffusion of a genuine knowledge of insects, of which there are probably from 50,000 to 100,000 species on this continent. Such work would, we believe, do an immense deal towards multiplying local observers, diffusing a knowledge of applied and scientific entomology among the masses, would develop the teaching of useful natural knowledge in the common schools, increase the number of scientific entomologists and general biologists, and would eventually place the sciences of botany and zoölogy upon the same level which they hold in other countries, and in the end add immensely to the natural resources of our soil and increase our national wealth.

—— The Academy of Natural Sciences of this city, has filled two more of the chairs, which it created four years ago, with competent professors. The two courses of lectures, on invertebrate palæontology, and mineralogy and stratigraphic geology, are an important acquisition to the educational facilities of the city, and will also serve to strengthen the scientific back-bone of the Academy. The institution is to be congratulated on having made such an important advance, and in having given such merited recognition to Messrs. Heilprin and Lewis.

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RECENT LITERATURE.

Wallace's Island Life.[1]—After the publication of his work entitled, "The Geographical Distribution of Animals," Mr. Wallace devoted four years' additional thought and research in

[1] *Island Life or the Phenomena and Causes of Insular Faunas and Floras*, including a Revision and attempted solution of the Problem of Geological Climates. By Alfred Russell Wallace. New York, Harper & Brothers, 1881. 8vo, pp. 522.

the same direction, with the result before us, a book rather more popular in its treatment of the general subject, and a little narrower in scope in those chapters confined to a discussion of the causes governing the peopling of the larger oceanic and continental islands. The result is a most interesting work, and one which will serve to maintain, if not greatly advance the general interest felt by naturalists in the general and attractive subject of the philosophy or explanation of the causes of the present geographical distribution of plants and animals.

The author attempts to explain the present distribution of life by reference to a complex of causes grouped as biological and physical. The biological causes are (1) the constant tendency of organisms to increase in numbers and to spread out, disperse and migrate; and (2) "those laws of evolution and extinction, which determine the manner in which groups of organisms arise and grow, reach their maximum, and then dwindle away, often breaking up into separate portions which long survive in very remote regions." The physical causes are (1) "geographical changes which at one time isolate a whole fauna and flora, at another time lead to their dispersal and intermixture with adjacent faunas and floras;" and (2) the changes of climate which have occurred in various parts of the earth. A good deal of space is devoted to the subject of geological climates and their causes, and this inquiry has led to an investigation of the mode of formation of stratified deposits, with a view to fix within some limits their probable age, also to obtain a rough estimate of the probable rate of development of the organic world; both of these processes being shown to involve, in all probability, periods of time less vast than have generally been thought necessary. These subjects are discussed in the author's clear, pleasing and popular style in the first part. And it is in this part that our readers will take the liveliest interest. The second part is an explanation of the phenomena presented by the floras and faunas of the chief islands of the globe.

Returning to the first part, among the more general results of modern science, which Mr. Wallace utilizes for his purpose, is the doctrine now gaining wide acceptance in Europe, and which had been taught by Dana and Agassiz years ago in this country, namely that of the general stability of continents; that the "grand features of our globe—the position of the great oceans and the chief land-areas—have remained, on the whole, unchanged throughout geological time." The continents have been built up mainly of shore deposits. "The general stability of continents has, however, been accompanied by constant changes of form, and insular conditions have prevailed over every part in succession." We shall refer farther on to this doctrine, and its vital influence on zoö-geography, a point apparently overlooked by Wallace and by most other writers on this subject.

Three chapters are devoted to the influence of the glacial epoch on the climate of the globe, and to the question of past glacial epochs and their causes. Mr. Wallace while adopting generally Mr. Croll's views as to the causes of the glacial epoch, limits and modifies his views by pointing out the very different effects on climate of water in the liquid and solid state, and that without high land there can be no permanent snow and ice. He concludes that the "alternate phases of precession, causing the winter of each hemisphere to be in aphelion and perihelion each 10,500 years, would produce a complete change of climate only where a country was *partially* snow-clad; while, whenever a large area became almost *wholly* buried in snow and ice, as was certainly the case with Northern Europe during the glacial epoch, then the glacial conditions would be continued, and perhaps even intensified, when the sun approached nearest to the earth in winter, instead of there being at that time, as Mr. Croll maintains, an almost perpetual spring." He also opposes the views of Mr. Croll and others as to the existence of general glacial epochs in earlier times, and claims that "the geological evidence leads inevitably to the conclusion, that during a large portion of the Secondary and Tertiary periods, uninterrupted warm climates prevailed in the north temperate zone, and so far ameliorated the climate of the Arctic regions as to admit of the growth of a luxuriant vegetation in the highest latitudes yet explored." He accepts Croll's hypothesis that the glacial epoch began about 200,000 years ago.

Mr. Wallace although a Darwinian as such, is not so extreme in his demands of unlimited time for the action of natural selection as the majority of his school. He duly respects the claims of the mathematicians and astronomers that the earth's age is to be reckoned by tens of millions rather than by larger figures, and adopts Sir William Thompson's conclusion "that the crust of the earth cannot have been solidified much longer than 100,000,000 years;" and Professor Haughton's estimate that the time to be required to produce the maximum thickness of the stratified rocks of the globe (177,200 feet) at the present rate of denudation and deposition is only 28,000,000 years. Now these are only guesses, but yet are useful, as indicating the order of magnitude of the time required. Mr. Wallace therefore claims that "so far as the time required for the formation of the known stratified rocks, the hundred million years allowed by physicists is not only ample, but will permit of even more than an equal period anterior to the lowest Cambrian rocks, as demanded by Mr. Darwin."

"In the tenth edition of the Principles of Geology, Sir Charles Lyell, taking the amount of change in the species of mollusca as a guide, estimated the time elapsed since the commencement of the Miocene as one-third that of the whole Tertiary epoch, and the latter at one-fourth that of geological time since the Cambrian period. Professor Dana, on the other hand, estimates the Tertiary as only one-fifteenth of the Mesozoic and Palæozoic combined. On the estimate above given, founded on the dates of phases of high eccentricity, we shall arrive at about four million years for the Tertiary epoch, and sixteen million years for the time elapsed since the Cambrian, according to Lyell, or sixty millions, according to Dana. The estimate arrived at from the rate of denudation and deposition (twenty-eight million years) is nearly midway between these, and it is, at all events, satisfactory that the various measures result in figures of the same order of magnitude, which is all one can expect in so difficult and exceedingly speculative a subject.

"The only value of such estimates is to define our notions of geological time, and to show that the enormous periods of hundreds of millions of years which have sometimes been indicated by geologists are neither necessary nor warranted by the facts at our command; while the present result places us more in harmony with the calculations of physicists, by leaving a very wide margin between geological time as defined by the fossiliferous rocks and that far more extensive period which includes all possibility of life upon the earth."

Another good point made by Mr. Wallace, and one to be commended to the consideration of ultra-conservative anti-evolutionists, is that the present condition of the earth is one of exceptional stability as regards climate, and that the result is an epoch of exceptional stability of species.

It will be seen by the extracts made and the general tone of this interesting work that the author has given us a calm, moderate and yet comprehensive survey of some of the most interesting problems of modern science.

Mr. Wallace not only discards some of the exaggerated hypotheses of well-nigh limitless geological periods, but also the far-fetched ideas of intercontinental bridges and temporary islands, which so excellent a biologist as Professor Huxley is fond of invoking even up to the present year, and of the hypothetical Lemuria of Haeckel, and has fully adopted the well-grounded view of the permanence of the present continents and ocean basins. To American geologists the origin of the North American continent from the Laurentian nucleus, and its gradual building up by sediments derived from the waste of its own rocks, is a familiar view. Keeping pace with this building up and extension of the continental land mass was the evolution of its flora and fauna, which have borrowed none of their features from the old world, though there may have possibly been an interchange of forms with the South American continent. It was not until near the close of the Tertiary, perhaps, that the American and Asiatic continents nearly met, and that it was possible for a slight interchange of forms to take place on the west, while possibly through Spitzbergen and other islands north of the European-Asiatic continent there may have been a slight interchange of forms. Simultaneous with the growth of the

American continent (considering North and South America for our purpose as one) the Europeo-Asiatic, African and Australian continents developed, with their characteristic assemblages of plants and animals.

We have been accustomed to teach for several years past, and have briefly stated the doctrine in our "Zoölogy"[1] that the different continents have been original distinct centers of distribution, and that analogous forms of life found in opposite continents have not necessarily been derived one from the other, but may have arisen through the influence of similar physical surroundings on different continents; in this way we would explain the origin of representative species. For example, the "Scandinavian" flora did not necessarily people America, but the flora now found in Northern and Arctic Europe probably originated over both Europe and America. The American opossums were not necessarily travelers from Australia by way of Europe, but more probably originated from the Mesozoic lands of North America. The American continent had its own marsupials, its own tapirs, its own Felidæ, Canidæ, horses, camels and monkeys, which independently evolved on American soil, while representative forms arose in Europeo-Asiatic lands. It seems to us that this view is a simple and natural one, in accordance with geological and palæontological facts. Did Mr. Wallace entertain similar views, it seems to us, he would find in such a reasonable theory a simple and ready explanation of many facts in zoö-geography which he now accounts for by extensive intercontinental migrations on a scale and extent which is opposed by many geological facts. This fact, as we regard it, of the independent evolution in different continents of representative genera and species, lies, it seems to us, at the basis of a rational explanation of many otherwise inexplicable problems. In the light of recent discoveries in American vertebrate palæontology and deep-sea explorations, the high antiquity and independent origin of our continental fauna as a whole seems well nigh proved. Of course, when we come to the glacial period, when the continents of America and Asia approached each other, there were possibly interchanges of species, and extensive migrations from north to south, with wide-spread extinctions, which renders the distribution

[1] Zoölogy for High Schools and Colleges. By A. S. Packard, Jr. New York, 1879. "The earth's surface may then be mapped out into general and special divisions. First, a tropical, temperate, and arctic or circumpolar fauna or realm; and, secondly, each continent may form a smaller subdivision or specific center—*i. e.*, the Europeo-Asiatic, the African, the Australian, and the South and North American regions, for each of these continental divisions have been peopled with types of animals which have been from the earliest geological times the original possessors of the soil, though they may have adopted members of each other's faunæ," p. 662. "It appears, then, that each continent has had from the first its distinct assemblage of life, and thus opposing continents, such as South America and Africa, have fundamentally different faunæ, because they have had a separate geological history." Ibid, p. 664.

of life in the northern hemisphere in the Quaternary so different from that of the Tertiary.

The only European naturalist, so far as we are aware, who has insisted on the independent origin of the different continental floras and faunas is Professor Carl. Vogt, in a recent article published in Westermann's Monatshefte, where he vigorously discusses the subject, and claims that the monogenists, or those who believe that different types have arisen from a single individual, are in the wrong; that different continents may have simultaneously produced representatives or similar species; and that we should not accept a single center of creation for all faunas.

Naturalists are again indebted to Mr. Wallace for an original work in a field which he has gleaned so successfully, bringing back to the storehouse of science a sheaf of genuine facts abounding with ripe inductions and containing but little chaff.

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GENERAL NOTES.

BOTANY.[1]

A Reformed System of Terminology of the Reproductive Organs of the Thallpohyta.—At the Swansea meeting of the British Association in August, 1880, Professor A. W. Bennett and

[1] Edited by Prof. C. E. Bessey, Ames, Iowa.

George Murray, presented a paper bearing the title given above. The following summary is furnished to the NATURALIST, by the authors of the paper:

In the fourth edition of his "Lehrbuch," Sachs defines a "spore" as "a reproductive cell produced directly or indirectly by an act of fertilization," reserving the term "gonidium" for those reproductive cells which are produced without any previous act of impregnation. The practical objections to this limitation of terms are pointed out, and it is proposed to restore the term spore to what has been in the main hitherto its ordinary signification, viz.: *any cell produced by ordinary processes of vegetation and not by a union of sexual elements, which becomes detached for the purpose of direct vegetative reproduction.* The spore may be the result of ordinary cell-division or of free cell formation. In certain cases (zoöspores) its first stage is that of a naked mass of protoplasm; in rare instances it is multicellular, breaking up into a number of cells (polyspores, composed of merispores, or breaking up into sporidia). Throughout thallophytes the term is used in the form of one of numerous compounds expressive of the special character of the organ in the class in question. Thus, in the Protophyta and Mucorini we have chlamydospores; in the Myxomycetes, sporangiospores; in the Peronosporeæ, conidiospores; in the Saprolegnieæ, Oöphyceæ, and some Zygophyceæ, zoöspores; in the Uredineæ, teleutospores, æcidiospores, uredospores, and sporidia; in the Basidiomycetes, basidiospores; in the Ascomycetes (including Lichenes), conidiospores, stylospores, ascospores, polyspores, and merispores; in the Hydrodictyeæ, megaspores; in the Desmidieæ, auxospores; in the Volvocineæ and Mesocarpeæ, parthenospores; in the Siphoneæ and Botrydieæ, hypnospores; in the Œdogoniaceæ, androspores; in the Florideæ, tetraspores and octospores. The cell in which the spores are formed is in all cases a sporangium.

In the terminology of the male fecundating organs very little change is necessary. The cell or more complicated structure in which the male element is formed is uniformly termed an antheridium, the ciliated fecundating bodies, antherzoids (in preference to "spermatozoids.") In the Florideæ and Lichenes, the fecundating bodies are destitute of vibratile cilia; in the former case they are still usually termed "antherozoids," in the latter "spermatia," and their receptacles "spermogonia." In order to mark the difference in structure from true antherozoids, it is proposed to designate these motionless bodies in both cases pollinoids; the term "spermogonium" is altogether unnecessary, the organ being a true antheridium.

A satisfactory terminology of the female reproductive organs presents greater difficulties. The limits placed to the use of the term spore and its compounds require the abandonment of "oöspore" for the fertilized oösphere in its encysted stage anterior to its segmentation into the embryo. The authors propose the syllable *sperm* as the basis of the various terms applied to all those bodies which are the immediate result of impregnation. It is believed that it will be found to supply the basis of a symmetrical system of terminology which will go far to reduce the confusion that at present meets the student at the outset of his researches. For the unfertilized female protoplasmic mass, it is proposed to retain the term oösphere, and to establish from it a corresponding series of terms ending in *sphere*. The entire female organ before fertilization, whether unicellular or multicellular, is designated by a set of terms ending in *gonium*.

In the Zygomycetes and Zygophyceæ, the conjugated zygospheres, or contents of the zygogonia, constitute a zygosperm; in the Oömycetes and Oöphyceæ the fertilized oösphere, or contents of the oögonium, is an oösperm; in the Carpophyceæ the fertilized carposphere, or contents of the carpogonium, constitutes a carposperm. In this last class the process is complicated, being effected by means of a special female organ which may be called the trichogonium (in preference to "trichogyne"). The ultimate result of impregnation is the production of a mass of tissue known as the cystocarp (or "sporocarp"), within which are produced the germinating bodies which must be designated carpospores, since they are not the direct results of fertilization. Any one of these bodies which remains in a dormant condition for a time before germinating is a hypnosperm. In the Cormophytes (Characeæ, Muscineæ, and vascular cryptogams) the fertilized archesphere, or contents of the archegonium, is an archesperm. In the proposed system zygosperm will replace Strasburger's "zygote," and the "gametes" of the same writer will be zygospheres, his "zoögametes" or "planogametes" being zoözygospheres.

In the Basidiomycetes, Ascomycetes and some other classes, it is proposed to substitute the term *fructification* for "receptacle" for the entire non-sexual generation which bears the spores.

Modes of Fertilization in Cryptogams.

ZYGOSPERMEÆ. Zygogonia, containing Zygospheres, producing after fertilization a Zygosperm.

	Male Organ.	*Female Organ.*
OOSPERMEÆ.	Antheridium, containing Antherozoids or Pollinoids.	Oogonium, containing Oosphere, producing after fertilization an Oosperm.
CARPOSPERMEÆ.	Antheridium, containing Antherozoids or Pollinoids.	Carpogonium, containing Carposphere, producing after fertilization a Carposperm.
CORMOPHYTA.	Antheridium, containing Antherozoids.	Archegonium, containing Archesphere, producing after fertilization an Archesperm.

Reproductive Organs of Thallophytes.

	Non-sexual.
PROTOPHYTA.	Chlamydospore. Sporangium.

	Female.	*Non-sexual.*
MYXOMYCETES.		Zoöspore. Sporangiospore.
MUCORINI.	Zygogonium. Zygosphere. Zygosperm.	Chlamydospore. Sporangiospore.
PERONOSPOREÆ.	Oögonium. Oösphere. Oösperm.	Sporangium. Conidiospore. Zoöspore.
SAPROLEGNIEÆ.		Zoöspore.
UREDINEÆ.	Carpogonium. Carposphere. Carposperm.	Teleutospore. Æcidiospore. Uredospore. Sporidium.
USTILAGINEÆ.		Teleutospore. Sporidium.
BASIDIOMYCETES.		Basidiospore. Sterigma. Basidium.
ASCOMYCETES, including LICHENES.	Trichogonium.	Conidiospore. Stylospore. Ascospore. Polyspore. Merispore.
ZYGOPHYCEÆ.	Zygogonium. Zygosphere. Zoözygosphere. Zygosperm. Hypnosperm (Hydrodictyeæ, Zygnemaceæ).	Zoöspore. Megazoöspore (Hydrodictyeæ). Auxospore (Diatomaceæ). Hypnosporangium } Botrydieæ. Hypnospore } Parthenospore (Mesocarpeæ).
OOPHYCEÆ.	Oögonium. Oösphere. Oösperm. Conceptacle. Hypnosperm.	Zoöspore. Parthenospore (Volvocineæ). Androspore (Œdogoniaceæ). Hypnospore (Siphoneæ).
CARPOPHYCEÆ.	Corpogonium. Carposphere. Carposperm. Trichogonium. Trichophore. Cystocarp.	Zoösporangium. Tetraspore. Octospore. Carpospore.

CURTISS' "NORTH AMERICAN PLANTS."—As is well known to many readers of the NATURALIST, Mr. A. H. Curtiss, of Jacksonville, Florida, has for several years been engaged in issuing annual fascicles of the more interesting North American plants, particularly of the southern species. Fascicle No. IV has just appeared, and, like its predecessors, it consists of beautifully preserved specimens. In turning over the numbers there is scarcely an inferior specimen to be found, and not one *poor* one.

The species are distributed quite evenly throughout the phanerogamia, and there are, besides, a few vascular cryptogams.

Many of the species are peculiar to South Florida, and will be valuable acquisitions to many herbaria. Quite a number of Texan species are represented by specimens collected by Mr. J. Reverchon. Among the species which will be interesting to many northern botanists may be mentioned *Vitis sicyoides* Benth. and Hook., a curious member of the Cissus sub-genus, and not at all grape-like in appearance; *Acer saccharinum* Wang. var *Floridanum* Chap., with its petite leaves and fruits; *Strumpfia maritima* Jacq., which has twigs and foliage with a decidedly coniferous look; *Garberia fruticosa* Gray; *Mimusops Sieberi* A. DC.; *Jacquinia armillaris* Jacq.; *Thrinax Garberi* Chap.; *Monanthochloë littoralis* Eng.

The Function of Lichen Gonidia.—George Murray, in the *Journal of the Linnean Society*, for October, attempts to apply the results of Pringsheim's recent researches on chlorophyll to the life of the lichen. The new view as to the function of chlorophyll is that instead of being the active agent in the decomposition of CO_2, it discharges the office of a screen to the protoplasm, which itself is the decomposing agent. Mr. Murray suggests that in lichens we have an experimental proof of the truth of this theory. "We have the lichen, the fungal tissues, as the body of the thallus, and the chlorophyll screen, in the gonidial layer; that is, the chlorophyll is in one system of cells and the protoplasm apparently affected by it in another, which is in contact. The light which traverses the chlorophyll-containing gonidial layer excites in the fungal tissues the decomposition of CO_2 In evidence of this I would point to the plentiful occurrence of starch, or rather lichenin, a substance of the same chemical composition as starch ($C_{12}H_{20}O_{10}$), and formed from it according to Masche (*Jour. Prakt. Chemie*, LXI, p. 7), by the action of the free acids of the plant. Further, I venture to submit that this process tends to explain the nature of the consortism of the fungal and algal elements in the autonomous lichen, and to support the well-known views of Schwendener."

Sets of North American Fungi.—It is impossible for the student of fungi to make much progress in the identification of species without having access to collections of authentic and well mounted specimens. In 1878, Mr. J. B. Ellis, of Newfield, N. J., began the distribution of his sets of "North American Fungi," and has continued the work with such rapidity that up to the present no less than five hundred species have been prepared and issued by him. Century v, sent out during January of this year, is a valuable one to the fungologist. Nearly all the orders of fungi are represented by species, there being of the Calcareæ (Myxomycetes) 1; of the Perisporiaceæ 9; the Helvellaceæ 22; Phacidiaceæ 11; Pyrenomycetes 35; Hymenomycetes 11; and of imperfect forms (probably of some Ascomycetes) 11. The specimens are in generous quantity for each species, and in most cases are put up loosely in envelopes pasted to the pages, thus making them doubly valuable for microscopical study.

PINUS BANKSIANA LAMB., ON THE SEA COAST OF MAINE.—Mr. C. G. Atkins, of Bucksport, Me., reports finding trees of this species in Orland, Hancock county, Me., and also in Washington county, near Harrington. The same tree was reported to him as growing on Cape Rosier, Schoodic point, and Beal's island. This pine has hitherto been catalogued as confined to "the northern borders" of Maine.

In this connection it may be well to point out that Professor Babcock in his "Flora of Chicago and Vicinity" (*The Lens*, 1872), records this species as being "abundant for several miles along the L. S. & M. S. R. R.," near the city; a locality not noted in our books and catalogues.

BENTHAM'S NEW CLASSIFICATION OF THE ORCHIDS.—At the meeting of the Linnean Society, Jan. 20, 1881, Bentham presented an important paper embodying the results of his detailed examination of all the genera proposed or established. He re-arranges them under five tribes and twenty-seven sub-tribes, as follows:

Tribe I. EPIDENDREÆ.		Tribe II. VANDEÆ.	
Sub-tribe 1.	Pleurothalleæ.	Sub-tribe 1.	Eulophieæ.
" 2.	Microstyleæ.	" 2.	Cymbidieæ.
" 3.	Liparieæ.	" 3.	Cyrtopodieæ.
" 4.	Dendrobieæ.	" 4.	Stanhopieæ.
" 5.	Erieæ.	" 5.	Maxillarieæ.
" 6.	Bletieæ.	" 6.	Oncidieæ.
" 7.	Coelogyneæ.	" 7.	Sarcantheæ.
" 8.	Stenoglosseæ.	" 8.	Notyileæ.
" 9.	Lælieæ.		

Tribe III. NEOTTIEÆ.		Tribe IV. OPHRYDEÆ.	
Sub tribe 1.	Vanilleæ.	Sub-tribe 1.	Serapiadeæ.
" 2.	Corymbieæ.	" 2.	Habenarieæ.
" 3.	Spirantheæ.	" 3.	Diseæ.
" 4.	Diurideæ.	" 4.	Corycieæ.
" 5.	Arethuseæ.		
" 6.	Limodoreæ.		

Tribe V. CYPRIPEDIEÆ.

BOTANICAL NEWS.—Mr. D. L. James has published in the Journal of the Cincinnati Society of Natural History (January, 1881), a valuable paper entitled "Notices of the Floras of Cincinnati, published from 1815 to 1879," in which he enumerates and comments upon the published lists, four in number.——Dr. Killebrew, the Commissioner of Agriculture of the State of Tennessee, has recently issued from his office a pamphlet of 164 pages on "Meadows and Pastures." The general treatment of the subject is much like that followed in Flint's "Grasses and Forage Plants," but it is much simplified so as to be more easily read by those who are not botanists. It is a valuable little work, and although not written for botanists, will prove interesting to them also.——Dr. Vines in the January *Journal of Botany* publishes a "History of the Scorpioid Cyme." The term has been used in two senses, resulting in considerable confusion; in the one sense it is made to include the helicoid cyme, while in the other the scorpioid and helicoid cymes are distinct. The latter which appears to be the best usage is, in the books used in this country, followed in Gray's Botanical Text Book, 6th edition; Bessey's Botany for High Schools and Colleges; Prantl's Text Book of Botany; McNab's Botany and Sach's Text Book of Botany. The erroneous usage is followed in Wood's Class Book of Botany; Wood's Botanist and Florist; Thome's Structural and Physiological Botany; Youman's Second Book of Botany; and the old edition of Gray's Botanical Text Book. In Dr. Vines' paper by an unfortunate printer's blunder, Figs. 1 and 2 are transposed.——An important work on the Morphology of the Florideæ by Agardh, has recently been published in Leipsic.——Dr. Kuntze has been studying the "Gulf Weed" *(Sargassum bacciferum)*, and finds that there are several species, instead of but one, as has commonly been supposed. His results are given in his recently published treatise, *Revision von Sargassum und das sogennante Sargasso-Meer.*" Leipsic, 1880.——Borzi describes a new Sardinian species of oak *(Quercus Morisii)* in the January number of *Nuovo Giornale Botanico Italiano.* It is apparently much like our Californian *Quercus agrifolia.*——In the January Bulletin of the Torrey Botanical Club, Francis Wolle describes, and figures twelve new species of North American desmids.——The editors of the *Botanical Gazette* began in the February number, the issue in a four page extra of a catalogue of the plants of Indiana——From experiments made under the direction of Professor Hilgard upon the grounds of the University of California "it seems evident," to quote the words of the report, "that there must exist localities in California with winters warm enough for the three more hardy kinds of Cinchona *(C. succirubra, C. officinalis*, and *C. condaminea)*. In the same report the date palm *(Phœnix dactylifera)* is said to be "even as a young seedling, perfectly hardy" upon the University grounds.——"The Plants of the Summit of Mt. Marcy" is the title of an interesting pamphlet by C. H. Peck, the State Botanist of New York, reprinted from the Seventh Report of the Adirondack Survey. Upon the open summit 137 species were found, distributed as follows; algæ, 1; fungi, 7; lichens, 31; hepaticæ, 10; mosses, 32; lycopods, 3; gymnosperms, 3; angiosperms, 50.——Thomas Meehan has recently reprinted in the *Gardener's Monthly*, and in pamphlet form, his paper on the Objects of Sex, and of Odor in Flowers, read before the A. A. A. S. at Saratoga, 1879.——J. G. Baker's "Synopsis of the Aloineæ and Yuccoideæ," fills ninety-three pages of the October and December numbers of the *Journal of the Linnean Society*. It contains full descriptions of all the species.——Dr. E. L. Sturtevant of South Framingham, Mass., has undertaken an investigation involving the ratios between the weight of fruits and their contained seeds; the number of perfect, shriveled and abortive seeds, etc. He has printed blanks which he asks observers in different parts of the country to fill and forward to him.——Uhlworm's *Botanisches Centralblatt* for 1881, fully sustains its high character. The promptness of its notices of botanical publications and papers is a source of wonder as well as of profit to its readers.——Botanists will be glad to learn that Centuries V and VI, of Ravenel's "Fungi Americani" are now nearly ready for distribution.

ZOÖLOGY.

VALUE OF THE HOUSE WREN AS AN INSECT DESTROYER.—Ornithologists and entomologists are always most properly and sensibly urging upon people the duty and necessity of protecting the birds. In fact, when any destructive insect appears in overwhelming numbers, the good offices of our feathered friends would seem to be almost our sole dependence for protection from their ravages. And yet our laws and usages are singularly defective, regarded simply from a selfish point of view—leaving humanity entirely out of the question. But the matter is constantly forcing itself upon public attention, and gradually we shall make laws which ought to have been upon our statute books from the foundation of the Government. In the meantime let us all, who have this subject at heart, keep on "preaching" until this glorious end is achieved. The observations I have been able to make during a residence of several years on a farm have convinced me that the common house wren is really one of our most valuable birds, not, perhaps, for what they have done, but from the possibilities wrapped up in their diminutive bodies. They are quite as social as the purple martin or the bluebird, and greatly surpass both of these in the rapidity with which they increase. I began several years ago to provide them with nesting-places in the vicinity of my buildings. Sometimes I fastened the skull of a horse or ox, or a small box, in a tree-top. But latterly I have made it a practice every spring to obtain thirty or forty cigar boxes for this purpose. If the box is long and large, I put a partition across the middle and make a hole through into each apartment. It it very seldom that these boxes are not occupied by one of these little families. In most instances two broods are annually reared in each nesting-place. One of my boxes last season turned out three broods of young wrens—six little hungry birds each time, or eighteen in all! I think a cigar box never before did better duty. The lamented Robert Kennicott stated that a single pair of wrens carried to their young about a thousand insects in a single day! Like all young, rapidly growing birds, they are known to be most voracious eaters, living entirely upon insects.

The point upon which most stress may be laid is this: That by providing them with nesting-places in our gardens, orchards or grounds, and not allowing them to be caught by cats or scared away by mischievous boys, we may have scores if not hundreds of them about us during most of the time in which insects are destructive. They undoubtedly return to the same localities to rear their young year after year. Last season I had up about thirty of these nesting-boxes, and all but two or three, which were not favorably located, were occupied. My crop of wrens could scarcely have been less than one hundred and fifty, and the old birds filled the air with music when they were not on duty in building their nests or feeding their young! The coming spring I intend to put up at least a hundred of these nesting-boxes in my orchards and groves, and I have no doubt I shall be repaid a hundred thousand fold for the little labor it costs. As long as they come back so regularly every year and in constantly increasing numbers, and serve me so well, I shall do all in my power to protect and encourage them. And I am of the opinion that when one species of social, useful birds can be made to congregate in such unusual numbers, others will come also. But the hardiness, sociability, love of the locality where it was reared, and wonderful fecundity of the little house wren, render it, in my judgment, one of the most valuable of all our insectivorous birds.—*Charles Aldrich, Webster City, Iowa, 1881.*

Our Social Blue-Jays.—None of our winter birds are so social as the blue-jays. We see them every day during our long, cold winters. Our barnyards are their favorite resorts, where they walk about very familiarly among the poultry and domestic animals, feeding upon the scattered or half-digested corn. Last night (Jan. 6), while I was passing a straw stack, a jay went whirling out of a small hole into which it had crawled a foot or more. This morning, as I write, the mercury is down to 24, so I suppose my jay had made the best possible provision to protect himself from the approaching low temperature. These birds and our little chickadees seem able to endure such extreme cold better than any others that remain with us all the year round. Soon after sunrise on any of these cold, clear mornings, they can be heard merrily chirping in the neighboring groves and thickets. —*Charles Aldrich, Webster City, Iowa, Jan. 7, 1881.*

Zoological Notes.—M. Jules MacLeod has contributed a brief paper to the Royal Academy of Belgium on the *rôle* of insects in the pollinization of heterostyle flowers (*Primula elatior*).——Mr. S. H. Scudder continues in the Library Bulletin of Harvard University, No. 17, his bibliography of fossil insects, beginning with A. G. Butler and ending with d'Eichwald.——A structural feature hitherto unknown among Echinodermata, found in deep-sea Ophiurans, is pointed out by Mr. T. Lyman in an essay under this title in the Anniversary Memoirs of the Boston Society of Natural

History. The feature in question consists of branches of minute spines of different forms, some resembling long-stemmed agarics or parasols with small shades. The question whether these novel shapes are spines or pedicellariæ or not, is not regarded by Mr. Lyman as a very important one, "since the pedicellaria is only a spine peculiarly modified. But it may be said that their supplementary character and abnormal shape give these parasol spines the position of what used to be carefully distinguished as pedicellariæ." Mr. Lyman has also distributed a preliminary list of the known genera and species of living Ophiuridæ and Astrophytidæ, with their localities, and the depths at which they have been found; and references to the principal synonyms and authorities, Cambridge, December, 1880.——The heart of the Stomapod Crustacea is said by Claus in *Zoologischer Anzeiger* to consist of an anterior heart-like wider section, and of an elongated many-chambered dorsal vessel, the anterior part corresponding with the Decapod heart and situated in the region of the maxillæ and maxillipedes. The dorsal vessel has twelve pairs of venous openings, and sends off thirteen pairs of lateral arteries as well as a posterior aorta. A median ventral artery is present extending the whole length of the ventral nervous cord, and a sympathetic nerve extends along the dorsal side of the dorsal vessel, forming a large ganglion cell on each chamber.——In the same journal for November 29, Dr. Krancher writes on the structure of the stigmata of insects. He distinguishes five types; of simple stigmata without lips, two forms, the simplest (1) representing a hole surrounded by a chitinous ring, and (2) where the stigma consists of a row of single stigmata surrounded by a common chitinous ring, and whose tube-like continuations form the trachea. Of stigmata with lips, the lips (3) are represented by a simple sparsely haired chitinous ridge; (4) the lips are roof-like, extended inwards, and show a luxuriant growth of hairs like felting, and (5) the round stigma has on one side a median piece extending into the center. He states that there are never more than ten pairs of stigmata.——In an interesting report on the edible fishes of the Pacific coast in the Report of the Commissioners of Fisheries of the State of California for 1880, Mr. W. N. Lockington gives some novel information in regard to the hag fish of that coast *(Polistotrema dombeyi).* While at Monterey he was shown, by Prof. D. S. Jordan, several rock cod which had been literally eaten alive by them and had washed ashore as mere shells. The hag enters by the gills, or occasionally by devouring the eye, and eats its way into the flesh of its victim, consuming it until it dies of weakness, but presumably leaving, like the ichneumons that prey upon caterpillars, the vital parts untouched until the last. The hag is fitted for its work by its suctorial mouth, which is terminal, soft, not provided with jaws, and forming a round opening when in use, as well as by two teeth on each side of the gullet. The mouth is surrounded by barbels, and in preserved examples is scarcely visible. The fishermen of Monterey declare that one of these parasitic fishes will devour a fish of six or eight pounds weight in a single night. It is especially destructive to fish taken in gill-nets. When the hulk is taken out of the net, the hag scrambles out with great alacrity. It reaches a length of fourteen inches, and is not used for food at Monterey. ——Prof. Verrill has described in the Proceedings of the National Museum, a large number of new mollusks, echinoderms, annelids, etc., many of which were obtained last summer in the remarkably successful dredging explorations of the U. S. Fish Commission about one hundred miles south of Newport, R. I., upon the slope of the continent where it plunges under the Gulf Stream. Among the most interesting discoveries were nearly fresh shells of *Argonauta argo*, which indicate that this shell must often be common near our coast. Quantities of a large, handsome but very fragile cup-coral (*Flabellum goodei* Verr.) occurred. While many of the species of every class obtained are Arctic or belong to the cold waters found at similar or greater depths on the coasts of Europe and in the Mediterranean, a few genera, like Avicula, Solarium and Marginella are related to southern or West Indian forms. Though the very large collections of specimens obtained on these three trips of the *Fish-hawk* have, as yet, been only partially examined, enough has already been done to prove this region to be altogether the richest and most remarkable dredging ground ever discovered on our coast. As we have before remarked, the scientific results of the work of the U. S. Fish Commission are of the highest value; were it not for Government aid in this direction, to say nothing of the practical value of such researches, as showing where and on what kind of food our edible sea fishes live in winter, we could never, by private enterprise, have arrived at the knowledge of our marine fauna which we now possess, nor have got at many facts in distribution which bear on geological and palæontological problems.——The *Bulletin* of the Museum of Comparative Zoölogy, Vol. VIII, No. 1, contains a preliminary study of the Crustacea dredged in the Gulf of Mexico by the U. S. coast survey steamer *Blake* in 1877, '78 and '79, by M. Alphonse Milne-Edwards; Mr. Alexander Agassiz being the naturalist of the expedition.——Although one of the toughest of mollusks, it appears, on the authority of Mr. A. W. Roberts in the *Scientific American*, that the winkle (*Sycotypus canaliculatus*) may be added to our list of edible mollusks, from the fact that a colony of colored people back of Keyport, N. J., known as "Winkle Town," live largely on these shell-fish.

ENTOMOLOGY.[1]

The French still looking toward American Vines.—The latest London papers bring information concerning the French Superior Commission on the Phylloxera, which lately held its final sitting under the presidency of the Minister of Agriculture and Commerce. The introduction of American stocks into the department of the Gironde was authorized. The commission then decided that no one had gained the £12,000 prize for an efficient remedy. The remedies approved by the commission continue to be, as before, submersion, sulphur of carbon and sulphocarbonate of potassium. They recommend further the continuance of State aid to those departments which are attempting the reconstitution of their vineyards by the aid of American descriptions. In certain departments this attempt has hitherto proved very successful. The nursery established at Saintes (Charente Inferieur) distributed last year 7000 roots and this year 30,000, and further anticipated providing double if not triple the last number next year, with the promised aid of Government.—*Pacific Rural Press.*

Legislation to control Insects injurious to Vegetation.—Professor C. H. Dwinelle, of the University of California, has been appointed by the California State Horticultural Society as a member of a committee to consider what legislation is desirable to check the spreading of noxious insects, and force land-owners to destroy them when practicable.

The committee has in mind a commission with power to investigate and abate nuisances in the way of neglected breeding grounds of insect pests, codling moth, scale insects, etc. They expect to be met by objections from the free American citizen, standing upon his constitutional right to do as he pleases with his own property, but they question his right to maintain an orchard which is unprofitable to himself and a pest in the neighborhood.

No laws have been passed in this country obliging the destruction of injurious insects, except in the case of the destructive locust of the West. These laws are given in the first report of the U. S. Entomological Commission on this insect. They have passed laws both in France and Germany to oblige the gathering of caterpillars, their eggs, etc., from fruit and shade trees. They also have in those countries many police regulations regarding the destruction of injurious insects and the prevention of injury to agriculture, forestry and horticulture. The local authorities have full power to rigidly enforce these laws and regulations, which, on the whole, do a great deal of good. The whole population of a district which is invaded by an insect enemy is, in case of emergency, at the command of the authorities, and what can

[1] This department is edited by Prof. C. V. Riley, Washington, D. C., to whom communications, books for notice, etc., should be sent.

be accomplished by such concerted and well-directed action is shown by the heading off of the threatened invasion of the Colorado potato-beetle some years ago. Of course such laws could not be very well enforced in this country; but we see no objection to a committee of surveillance empowered to order the suppression of certain insects at any particular point where such are allowed to multiply unchecked, to the injury of the neighborhood. A penalty might be attached for the non-performance of work ordered by such committee, as in the case of all other laws requiring work for the common good. That intelligent suppression, in this manner, of many insects, such as scale-insects, Phylloxera, or even of fungus diseases, would be productive of much general good in preventing the spread of, or in decreasing, injury, there can be no question, and we sincerely hope that our California friends will succeed in their efforts to get such a law.—*C. V. R. in Farmers' Review.*

ON SOME INTERACTIONS OF ORGANISMS.—We have received an advance copy of a brochure with this title by Professor S. A. Forbes, extracted from Bulletin No. 3 of the Illinois State Laboratory of Natural History. It contains some thoughts and generalizations that have grown out of that writer's studies on the food of birds, insects and fishes, and the interrelation and interdependence of these animals. Professor Forbes finds that it is extremely unlikely that a species injurious to man's interest and well-being can ever be exterminated or even permanently lessened in numbers by a parasite strictly dependent upon it. This is a conclusion which greatly diminishes the importance of parasitism in the warfare by man against insects or other animals injurious to him, whether directly or indirectly. He rightly maintains that the interests of a species of plant or animal and the interests of its enemies "are identical, and since the operations of natural selection tend constantly to bring about an adjustment of the species and its enemies which shall best promote this common interest; therefore, *the annihilation of all the established 'enemies' of a species would, as a rule, have no effect to increase its final average numbers.* This being a general law, applying to all organisms, it is plain that the real and final limits of a species are the inorganic features of its environment,—soil, climate, seasonal peculiarities, and the like."

He contends that we get more protection against the inordinate increase of noxious insects, from predaceous birds and predaceous insects which eat a mixed food, because in the absence or diminution of any one element of their food their own numbers are not seriously affected, and, as a consequence, they are more generally ready, upon occasion, for effective attack on a threatening foe than any special parasite can be whose increase and decrease are more intimately dependent upon the increase and decrease of its prey. Reasoning from this standpoint the superiority of insectivorous birds becomes plainly manifest, their wing power enabling them to escape scarcity in one region which might otherwise decimate them, by simply passing to a more favorable region where they can find food. It does not follow, however, from these facts that the indefinite multiplication of either birds or insects is beneficial, since there is a limit beyond which such multiplication becomes harmful.

We recommend and heartily endorse the following concluding passages from the paper:

"We are therefore sure that the destruction of any species of insectivorous bird or predaceous insect is a thing to be done, if at all, only after the fullest acquaintance with the facts. The natural presumptions are nearly all in their favor. It is also certain that the species best worth preserving are the mixed feeders and not those of narrowly restricted dietary (parasites, for instance) —that while the destruction of the latter would cause injurious oscillations in the species affected by them, they afford a very uncertain safeguard against the *rise* of such oscillations. In fact, their undue increase would be finally as dangerous as their diminution. * * *

"When we compare the results of the primitive natural order with the interests of man, we see that, with much coincidence, there is also considerable conflict. While the natural order is directed to the mere maintenance of the species, the necessities of man usually require much more. They require that the plant or animal should be urged to excessive and superfluous growth and increase, and that all the surplus, variously and widely distributed in nature, should now be appropriated to the supply of human wants. From the consequent human interferences with the established system of things, numerous disturbances arise, many of them full of danger, others fruitful of positive evil. Oscillations of species appear, not less injurious to man than to the plants and animals more directly involved. Indeed, most of the serious insect injuries, for example, are due to species whose injurious oscillations have resulted from changes of the organic balance initiated by man.

"To avoid or mitigate the evils likely to arise, and to adapt the life of his region more exactly to his purposes, man must study the natural order as a whole, and must understand the disturbances to which it has been subject. Especially, he must know the forces which tend to the reduction of these disturbances, and those which tend to perpetuate or aggravate them, in order that he may reinforce the first, and weaken or divest the second.

"The main lesson of conduct taught us by these facts and reasonings, is that of conservative action and exhaustive inquiry. Reasoning unwarranted by facts, not correctly and sufficiently reasoned out, are equally worthless and dangerous for practical use."

BARON de Chaudoir, of Russia, R. H. McLachlan, of England, and Baron C. R. Osten Sacken, formerly Russian Consul General to this country, have been elected honorary members of the Belgian Entomological Society to fill the vacancies caused by the deaths of Boisduval, Mulsant and Snellen van Vollenhoven.

INSECT LOCOMOTION.—M. G. Carlet, of France, has been studying the locomotion of insects and arachnids, and reports as the result of his observations that the walking of insects may be represented by that of three men in Indian file, the foremost and hindmost of whom keep step with each other, while the middle one walks in the alternate step. The walking of arachnids is represented by four men in file, the even-numbered ones walking in one step, while the odd-numbered ones walk in the alternate step.

PLANT-FEEDING HABITS OF PREDACEOUS BEETLES.—In a recent letter Mr. V. T. Chambers suggests that when Harpalus has been recorded as feeding on the seeds of *Ambrosia artemisiæfolia* it may have been feeding on the larvæ of *Gelechia ambrosiæella* which lives in those seeds. In reply we would remark that during the past year the question of the herbivorous habits of certain predaceous beetles has been settled beyond all peradventure. Notices of such habit, always considered exceptional among Carabidæ or ground-beetles, appear in a number of European works, and *Zabrus gibbus* more particularly has been known to be quite destructive to grain.[1] Coleopterists have always been inclined to doubt the accuracy of these charges, and those who believe in the unity of habit in a given genus or family are also slow to accept statements that indicate exceptional habits. In Bulletin 3 of the Illinois State Laboratory of Natural History, Mr. F. M. Webster, of Waterman, Ill., who had previously communicated his experience with certain species of Harpalus and Anisodactylus, charging them with being particularly fond of the unripe seeds of some grasses,[2] has given a more detailed account of the herbivorous inclination of various Carabidæ and even of one species of Coccinellidæ (*Megilla maculata* DeGeer). His observations and actual detection of the insects partaking of such vegetable food cannot longer be questioned, as they are fully confirmed and supported in a valuable paper in the same Bulletin by Prof. Forbes, Director of the Laboratory, who, by a series of microscopic examinations of the stomachs of various predaceous beetles, has confirmed the observations of Mr. Webster and proven beyond question that, while the habit of the Carabidæ is in the main carnivorous, yet a large number of the species feed upon either the spores of different fungi, the pollen of flowers, or the seeds of grasses and grains. Out of twenty-eight specimens, representing seventeen species belonging to the genera Galerita, Loxopeza, Calathus, Anisodactylus, Amara, Harpalus, Cratacanthus, Evarthrus, Pterostichus, Chlænius and Bradycellus, twenty specimens belonging to eleven species had eaten vegetable

[1] See Curtis' "Farm Insects," p. 388.
[2] *Am. Ent.*, III, p. 26.

matter of some sort. In fact about one-half the food of these twenty-eight specimens consisted of vegetation, one-third of it being derived from Cryptogamia and the rest from grasses and Compositæ.

Still more startling, however, are the results of his examinations of different Coccinellidæ or ladybirds. *Coccinella novem-notata, Brachyacantha ursina, Hippodamia convergens* and *Megilla maculata* were all found to be extremely fond of the spores of fungi and some of them of the pollen of different Compositæ, the last named species in addition to fungus spores and pollen grains (probably those of the common dandelion), was proven to feed also upon the anthers and pollen of grasses. We have long been suspicious that this species was almost as thoroughly a vegetable feeder as the well-known northern squash-beetle *(Epilachna borealis)*, which was always supposed to be the only exception to the carnivorous habits of its family.

In July, 1874, we received a number of specimens of this Megilla from Mr. Geo. B. P. Taylor, of St. Inigoes, Md., who reported them as having done considerable injury to corn by eating holes in the blades, and specimens of blades that were riddled and perforated accompanied the beetles. We have on one or two occasions since endeavored to test the vegetable feeding habit of this insect in confinement, but without success, though it freely partook of the eggs of other insects, while we have known it to feed indiscriminately on the eggs, larvæ and pupæ of *Lina scripta*, or the streaked cottonwood-beetle.

Mr. Chambers' note refers to a communication by Mr. Wm. Trelease in the *American Entomologist*,[1] who found the common *Harpalus caliginosus* engaged in eating the contents of the partly-grown seed of the Rag-weed *(Ambrosia artemisiæfolia)*, which observations were confirmed by Prof. W. A. Buckhout,[2] of the State College, Center Co., Penn., who believed that he had in addition found this beetle feeding upon the pollen of the staminate flowers of the same plant.

In accordance with his general conclusions indicated in a notice in the present number "On some Interactions of Organisms," Prof. Forbes believes that this partial herbivorous habit among the predaceous beetles renders them more valuable to man than they would be if confined solely to animal food. To use his own language: "As a prudent sovereign finds it worth while to maintain a much larger fighting force than is necessary to the ordinary administration of his government, in order that he may have always a reserve of power with which to meet aspiring rebellion, so it is to the general advantage that carnivorous insects should abound in larger numbers than could find sustenance in the ordinary surplus of insect reproduction. They will then be prepared to

[1] Vol. III, p. 251.
[2] Ibid., p. 277.

concentrate an overwhelming attack upon any group of insects which becomes suddenly superabundant. It is evidently impossible, however, that this *reserve* of predaceous species should be maintained unless they could be supported, at least in part, upon food derived from other sources than the bodies of living animals."

NOTES ON PAPILIO[1] PHILENOR.—In the *Canadian Entomologist* for January, 1881, Mr. W. H. Edwards, of Coalburgh, W. Va., describes in full the egg and earlier stages of this interesting butterfly. Mr. Edwards remarks that the larva must undoubtedly feed upon some other plant than Aristolochia, since Mr. Mead found the female ovipositing on the leaves of a slender vine some years ago near Coalburg. In 1873 we made notes and descriptions of the egg and larval stages of this insect as found around St. Louis, where *Aristolochia serpentaria* and *A. sipho* are very

FIG. 1.—*Papilio philenor* (after Riley).

rare, and where the commoner species in the woods upon which the larva feeds is *A. tomentosa*. This species is so unlike the others that a non-botanist would scarcely, at first, suppose it to belong to the same genus, and it is probably the vine referred to by Mr. Edwards, and which he neglected to determine. As bearing on the generic value of Hübner's *Laërtias*, the early stages of Philenor are very interesting, approaching as it does Ornithoptera. The eggs show really no difference in sculpture from those of the other N. A. Papilios, the great difference in appearance being caused by a gummy coating. We found them during the month of July, on *Aristolochia tomentosa*, in patches of 16–20,

[1] *Laërtias* Hübn., as proposed by Scudder.

sometimes laid on the stem, sometimes on the upper side of the leaf, and we repeat here the brief description then made:

Sub-spherical, having a flattened base. Diameter 1 mm. The surface perfectly smooth and, when fresh, the color yellowish; but as the embryo develops, the color deepens to reddish-brown. The general color, however, more or less ferruginous, owing to the surface being coated with a gummy substance of this color, which accumulates in little translucent lumps more or less irregular, but generally showing about a dozen rib-like series from the crown. Spines of the embryo as it matures visible through the shell. Shell so delicate that it collapses in drying if soaked in alcohol. The viscid covering is dissolved in alcohol or chloroform.

The newly hatched larva strongly recalls some larvæ of Acronycta and also the young of Attacus. But it is structurally very similar to the first larval stage of our other North American Papilios, so far as we have observed them, especially of Asterias, the tubercles being more pronounced, though it differs from the other species in being at first gregarious. This last difference in habit can, however, have no generic value whatever, as we find similar exceptions in other genera, *e. g.*, *Apatura herse* and *Sphinx catalpæ*, in which the eggs are laid in masses and the young are gregarious, though in the other species of either genus, the eggs are laid singly and the larvæ are solitary. Harris[1] gives an excellent account of the newly hatched larva, which he likens to the (presumably full grown) larva of Ornithoptera, and after giving an account of the larval changes, and of the pupa, expresses the opinion that the species is a connecting one between Papilio and Ornithoptera. The butterfly appears very early in the spring, and we have even known it to issue in mild weather in November at St. Louis. We further quote from our notes in regard to the newly-hatched larva:

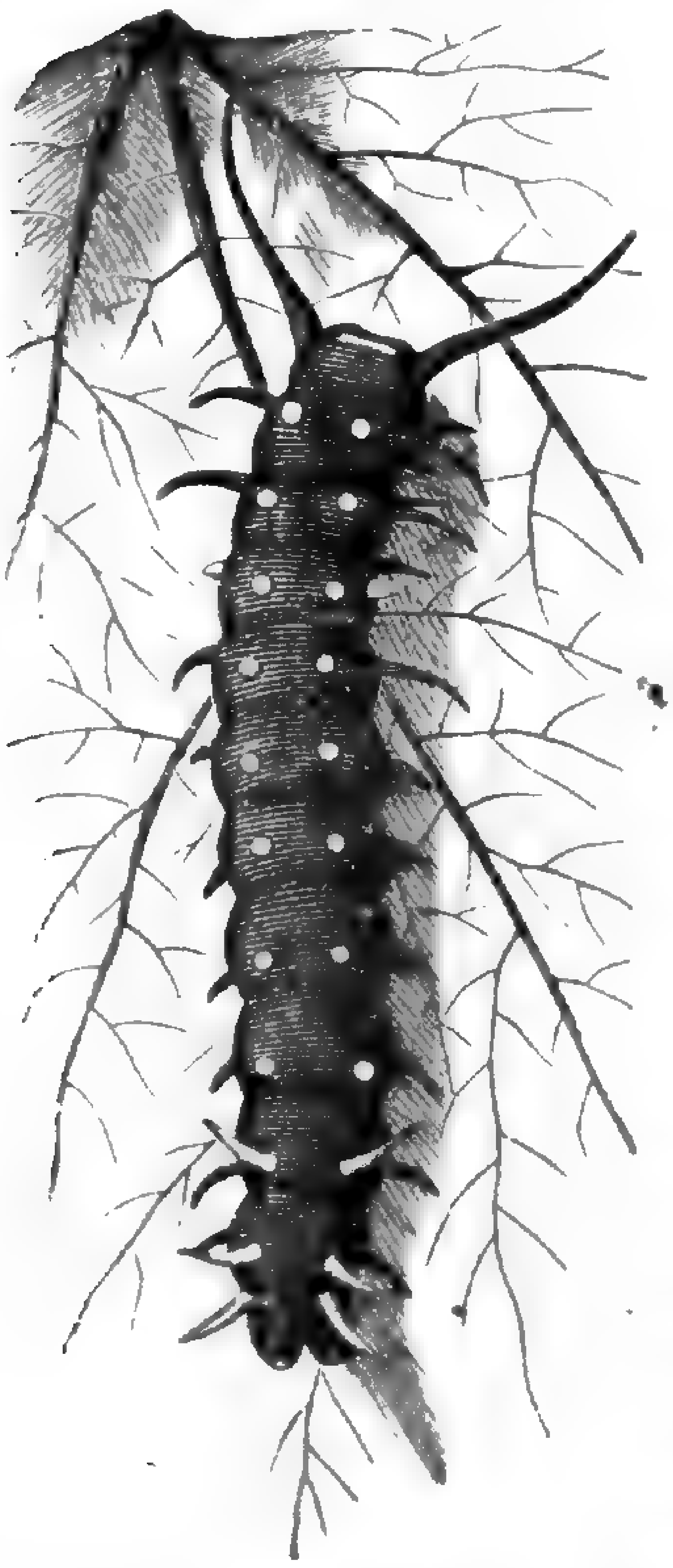

FIG. 2. Larva of *Papilio philenor* (after Riley).

Length 2.3 mm. Ferruginous-brown, the head and legs black. Eight rows of small, black, conical tubercles, each bearing a stiff black hair as long as or longer than the diameter of the body; four of the tubercles dorsal, and trapezoidal on all joints but second and third, the trapezoid reversed (*i. e.*, the anterior pair of tubercles wider apart than the posterior pair) on the black and polished cervical shield. There is, besides, a subventral and a ventral row of less conspicuous tubercles, generally concolorous with body and most prominent on the legless joints. On the second or third day the outer row of dorsal tubercles increase in size and become paler at base, and this is especially the case on prothoracic joint.

Mr. Edwards describes in detail the larval changes, and shows that there are only four molts instead of five, as he formerly supposed, which accords with our own notes. We gave some

[1] Correspondence, edited by S. H. Scudder, pp. 147, 273.
Harris's Companion, p. 247.

account of the insect in 1869,[1] from which the accompanying figures are taken.

Mr. Scudder communicated to us some years ago an interesting fact in reference to this species. It appears that the caterpillar, in 1840, ravaged the Aristolochias in the Botanic Garden at Cambridge,[2] and had never afterwards been seen in that vicinity until some plants of Aristolochia were taken from the Botanic Garden to Beverly, a few miles distant, when caterpillars appeared, in 1876, on the Beverly plants. Dr. Hagen recently notes their reappearance at Cambridge, presumably last year, as early as June.[3]

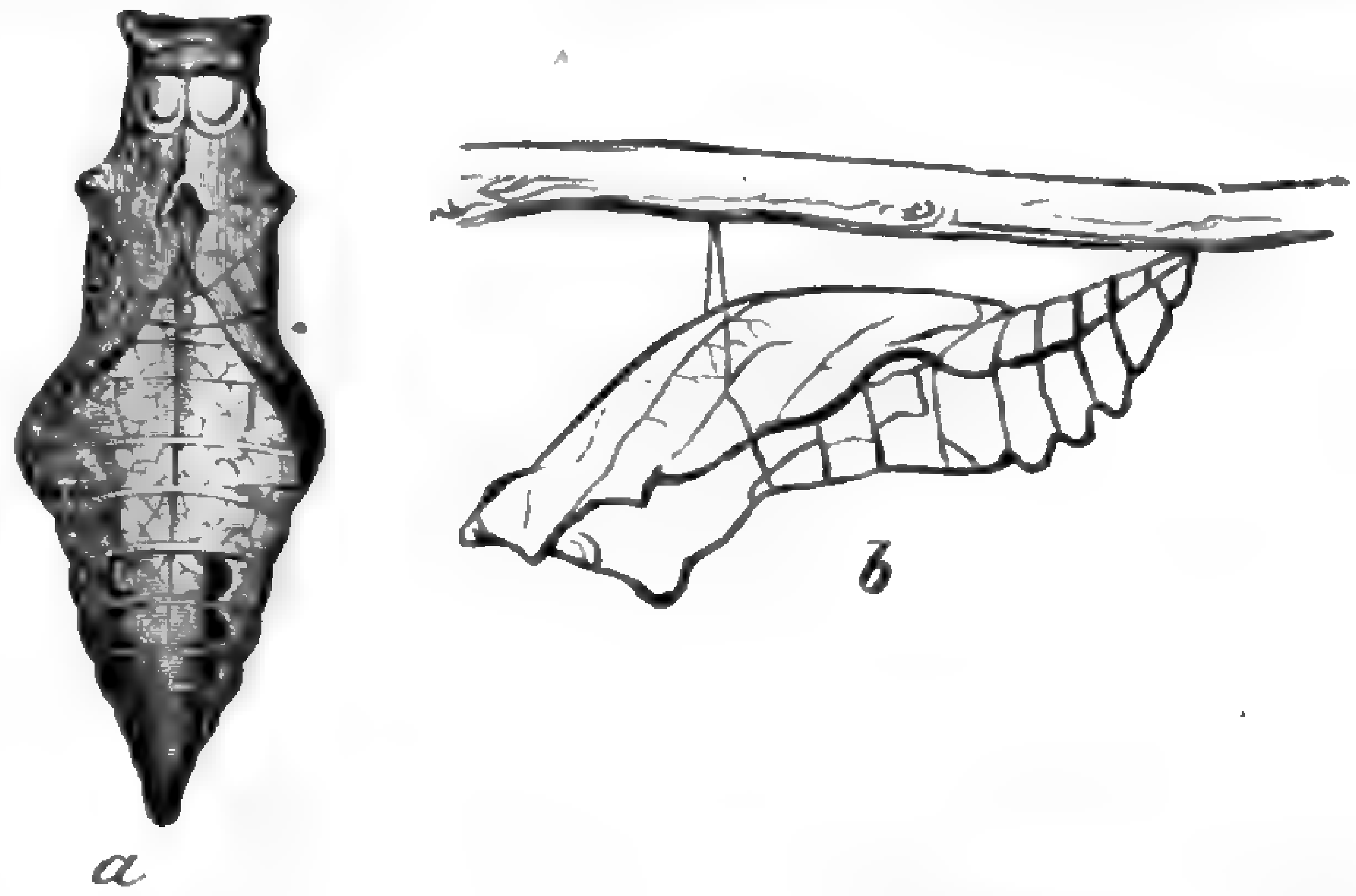

FIG. 3.—Chrysalis of *Papilio philenor* (after Riley).

We do not know of any records of this butterfly swarming, as several other species are known to do, but the following letter accompanied by specimens, addressed to us by the Rev. C. P. B. Martin, of Huntsville, Texas, March 5, 1874, shows that this species, too, may and does, in the Southern States, congregate in such swarms.

"I send you herein enclosed a butterfly, and though it is by no means a *rare* one, yet from the multitudinous swarms of it now flying about and literally *filling* the peach trees now in full bloom, I wish to know something more about it. I never saw so many butterflies of any one kind as there now are of this. The little yellow fellows that are seen in the summer around 'mud puddles' in the road, are few in comparison."—*C. V. Riley.*

ANATOMY OF THE MILKWEED BUTTERFLY.—Mr. Edward Burgess has lately published a paper on the structure of *Danais archippus*, which describes the anatomy of that butterfly with rare accuracy and clearness. Students of insect anatomy will especially appreciate this memoir, contained in the anniversary volume of the Boston Society of Natural History. It is one of the best entomological articles yet published, and makes us look forward eagerly to the appearance of other monographs upon other species of insects, which Mr. Burgess is understood to be engaged upon. The general figure (Pl. 1, Fig. 2) of the anatomy of Danais is particularly good, and ought to be copied into the text books. The author has elucidated many points, erroneously described or entirely overlooked by earlier writers. To him we owe the important discovery of a pharynx, or true sucking

[1] 2d Rep. Ins. Mo., pp. 116–118.
[2] See also Harris, *loc. cit.*, p. 147.
[3] *Can. Ent.*, Feb., 1881, p. 37.

stomach in the head, and of the extraordinary course of the aorta in the thorax, and the elucidation of the very complicated arrangement of the sexual organs. Even the gifted dissector, Newport, blundered badly in these matters. We can, therefore, better appreciate the skill requisite to avoid a repetition of these long accepted errors. The whole field of insect anatomy has been much neglected; we hope, therefore, that other investigators will add to the excellent contributions of Mr. Burgess.—*C. S. M.*

Entomological Notes.—The second number of the new journal *Papilio*, organ of the New York Entomological Club, comes to us with an increased number of pages. There are many descriptions of new forms by Mr. Henry Edwards and Mr. Grote; among those by the latter, two species of Phycidæ injuriously affecting hickory, *Acrobasis caryæ* boring the twigs of *Carya porcina* and *Ac. angusella* boring the leaf-stem, presumably of the same species. If our memory serves us right, Edwardsia, the new generic name proposed by Mr. Neumœgen for the beautiful moth figured on the plate in the first number, is preoccupied for a genus of Actinozoa; and the name Oribates, proposed by Mr. Henry Edwards, in the second number, for a genus of small moths is preoccupied among the mites (Acarina).——In the Proceedings of the Boston Society of Natural History for January, 1880, Dr. Hagen describes a remarkably large species of Simulium (*S. pictipes*, n. sp.), the larvæ and pupæ of which were found in the rapids of the Au Sable river, Adirondack mountains. We have the larvæ and pupæ of what is presumably the same species, found by Messrs. Hubbard and Schwarz, in the rapids of the Michipicoten river, north shore of Lake Superior, and it is probable that this is the celebrated "black-fly" of that region. In the rapids of the Michipicoten the larvæ were found to have the peculiarity of floating in long single strings attached to each other by silken threads and the pupæ found in the quieter pools close by, resemble clusters of coral. Mr. Schwarz informs us that the Hudson Bay Company has furnished its employés with oil of tar as a protection against these flies, and he confirms from his own experience the fact that it is much better than pennyroyal or any other substance recommended for the purpose.——We learn from Mr. H. K. Morrison, of Morganton, N. C., that, after much delay, he has just received the insects collected by him last summer in California and Washington Territory.——At a recent meeting at Rochester, of the Western New York Horticultural Society, papers on insects affecting horticulture were read by Messrs. C. D. Zimmerman and Wm. Saunders.——Two bills have been presented before the California Legislature aiming to protect the careful farmer from insect pests bred upon the lands of shiftless neighbors.——Mr. Wm. B. Lazenby finds whale-oil soap the best specific for destroying cabbage-worms, and treats of other insecticides in the *American Rural Home* of February, 19th.

He has probably not tried our favorite remedy, Pyrethrum water. —— The *Pacific Rural Press* cites some successful experiments made by Mr. W. H. Gilmore, in the use of crude petroleum for destroying the scale insects on the bark of fruit trees.——Mr. A. E. Hodgson gives in the *Entomologists' Monthly Magazine* for February, a remarkable instance of vitality exhibited by the rhynchophorous genus Otiorhynchus, some specimens of *O. ambiguus* surviving after being left for over eight months in a poison bottle, consisting of a stopped glass jar with fresh laurel leaves which kill most insects in a few minutes. It is well known that other species of this genus have been kept in spirits of turpentine, in alcohol and in the cyanide bottle for days without being killed.——Dr. Theobald at a recent meeting of the Maryland Academy of Sciences, showed a beetle weighing twô grains which moved 1320 times its own weight.——Dr. Horn publishes in the proceedings of the American Philosophical Society, a review of the species of Anisodactylus, and critical notes on the species of Selenophorus, giving synopses of all the species of these genera of ground-beetles found in the United States.——In the latest part of the *Stettiner Entomologische Zeitung* is a short article on the larvæ of Parnidæ, by C. W. Friedenreich of Blumenau, Brazil. ——Mr. A. D. Michael has read before the Linnean Society, an interesting paper on the life-history of the Gamasidæ, a family of mites which are very common parasites of beetles.——Professor T. J. Burrill writes in the *New York Tribune*, February 16th, regarding two cases in which plant-lice were found to be offensive in wells penetrated by roots of willow trees near Champaign, Ill.——In *Nature* for January 13, is an abstract of a paper read before the Linnean Society by Sir John Lubbock, relating to the habits of ants. An account is given of the care with which the ants keep in their nests over winter the eggs of plant-lice.

ANTHROPOLOGY.[1]

ANTHROPOLOGY IN FRANCE.—In connection with the Exposition at Paris in 1878, was held the "Congrès International des sciences anthropologiques." The superb collections of specimens illustrating every department of anthropology added very much to the interest and value of the papers read. These communications have now been collected and published in a volume bearing the name of the Congrès. Their titles will be found below:

D'Acy (E.)—Notes sur les patines des silex taillés des alluvions de Saint-Acheul, et sur l'ordre de leur superpositions, 234–237.

Ameghino, F.—L'homme préhistorique dans le bassin de la Plata, 341–350.

Bataillard, P.—Historique et préliminaires de la question de l'importation du bronze dans le nord et l'occident de l'Europe par les Tsiganes, 153–166.

Beddoe, J.—Sur quelques crânes d'un vieux cimetière de Bristol, 283–285.

Benedikt, M.—Sur les cervaux des Criminels, 141–148.

[1] Edited by Prof. OTIS T. MASON, Columbian College, Washington, D. C.

Bordier—Rapport sur l'ethnologie de l'Asie orientale, de l'Afrique, et de l'Oceanie, 39–47.
Capellini, G.—Incisions sur des os de cétacés tertiaires, 224–234.
Cartailhac, E.—Rapport sur la paléoethnologie; période Robenhausienne ou de la pierre polie, 51–56.
Chil—Memoire sur l'origine des Guanches ou habitants primitifs des îles Canaries, 167–220.
Daleau, F.—Notice sur les stations préhistoriques de l'etang de Lacanau, arrondissement de Bordeaux (Gironde), 351–354.
Dupont, E.—Sur les Nutons, 124–126.
Girard de Rialle—Rapport sur l'ethnologie de l'Europe, de l'Asie occidentale, et de l'Amérique, 35–39.
Hovelacque, A.—Les races inférieur, 264–266.
Jacquinot, H. et P. Usquin—Le nécropole de Pougues les-Eaux (Niévre); derniers temps de l'age du bronze, 238–250.
Latteux—Procédé pour obtenir des coupes rigoreusement transversales du cheveu, 98–105.
Le Bon, G.—Recherches anatomiques et mathematiques sur les variations de volume du crâne, 72–75.
Maurel, E.—Etude anthropologique sur les immigrants indiens a la Guyane française, 75–98.
Mortillet, G. de—Découverte de l'Amerique aux temps préhistoriques, 267–273.
Pagliani, L.—Etudes anthropométriques, 62–72.
Richard—Sur des découvertes de silex taillés dans le Sahara africain, en Egypte et en Palestine, au tombeau de Josué, etc., 278–282.
Royer, Mme. C.—Des rapports des proportions du crâne avec celles du corps, et des caractères correlatifs et évolutifs en taxonomie humaine, 105–119.
———Mémoire sur l'origine des Aryas et leurs migrations, 304–333.
Schmidt, V. — De l'age de bronze en Europe et notamment en Scandinavie, 285–288.
Souché—Une Sépulture de l'epoque Robenhausienne, ou de la pierre polie, a Pamproux (Deux Levres), 336–340.
Thomas, P.—Recherches sur les sepultures anciennes des environs D'Aïn-el-Bey (near Constantine, Algiers), 358–385.
Topinard, P.—De l'unification des methodes craniométriques et en particulier de cubage des crânes et du plan alveolo-condylien, 135–144.
———Rapport sur l'anthropologie, anatomique, biologique, et pathologique, 29–35.
Ujfalvy, de C.-E.—Quelques observations sommaires sur les races en Asie Centrale, 126–135.
Zabarowski, S.—Des monuments prehistoriques de la basse vistule, 259–264.
Zawisza J.—Sur la caverne du mammouth (en Pologne), 220–222.
Zeballos, E. S.—Note sur un tumulus prehistorique de Buenos-Ayres, 148–153.

The History of Religion.—It is well nigh impossible to keep pace with the multiplication of anthropological journals. We have to record, among the number a new aspirant, entitled "Revue de l'Historie des Religions, publiée sous la direction de M. Maurice Vernes avec le concours de MM. A. Barth, A. Bouche-Leclercq, P. Decharme, S. Guyard, G. Maspero, and C. P. Tiele (of Leyden). Première année, Tome II, No. 5, Septembre, Octobre. Paris, Ernest Leroux, Editeur, 1880 (Annales due Musée Guimet). The Review is purely historical, excluding everything of a polemic or dogmatic character. A very excellent bibliography is appended to each member.

German Anthropology.—The third of the series of bibliographical lists, in the *Archiv für Anthropologie* is a quarto brochure of 136 pages, by Frederick Ratzel upon ethnography and travels (Völkerkunde und Reisen), covering a period from July, 1878, to December, 1879. Dr. Emil Schmidt, of Essen, in Rhenish Prussia, is the editor of the *Archiv* in charge of matters relating to our country. The readers of the Naturalist who have published papers on anthropology would do well to send a copy of each to Dr. Schmidt.

The Trenton Gravels and Early Man.—Mr. Henry Carville Lewis sends us a pamphlet reprint from the Proceedings of the Acad. of Nat. Sciences of Philad., entitled "The Trenton Gravel and its Relation to the Antiquity of Man." After going over the ground carefully as a geologist, the author comes to the following conclusions:

1. That the Trenton gravel, the only gravel in which implements occur, is a true river deposit of post-glacial age, and the most recent of the gravels in the Delaware valley.

2. That the palæoliths found in it really belong to and are a part of the gravel, and that they indicate the existence of man in a rude state at a time when the flooded river flowed on top of this gravel.

3. That the data obtained do not necessarily prove, geologically considered, an extreme antiquity of man in Eastern America.

Mica Veins.—Mr. W. C. Kerr, State Geologist, Raleigh, North Carolina, read a paper before the American Institute of Mining Engineers, at the New York meeting, February, 1881, on the mica veins of North Carolina. The source of supply for various aboriginal products has become an important branch of archæological study. The result of the very latest investigations prove that copper and other substances were not transported so far as the first students of ancient commerce supposed. This does not vitiate their labors, but rather points to the wider diffusion of each separate industry than was suspected a few years ago.

The American Antiquarian.—The October number of this quarterly contains the following:

The emblematic mounds and the totem system of the Indian tribes. By Rev. S. D. Peet.
Relics of aboriginal art and their ethnological value. By Col. Charles Whittlesey.
Ancient quartz workers. By Miss Frances E. Babbitt.
The Rabbit and the Grasshopper: an Otoe myth. By Rev. J. O. Dorsey.
On the alabaster quarries and flint-works found in Wyandotte cave. By Rev. H. C. Hovey.
Aboriginal use of copper in war and in peace. Prof. J. D. Butler.
Correspondence.—The Chemakum Language. Rock-made Effigies. A curious prehistoric relic. Mounds in Kansas. Another nest of arrow-flints. Stone image found in gravel. Indian village sites.
Editorial Notes.—Gleanings from Magazines.—Book Reviews.

This number commences Vol. III, and is not behind its predecessors in the variety and value of its material.

The Bronze Age in Germany.—Our readers will remember the superb volume of M. Chantre upon the Bronze age. We have to draw attention to a second work that has just fallen into our hands, though bearing the imprint of 1878. It is entitled, "Die Bronzeschwerter des Königlichen Museums zu Berlin. Herausgegeben im Auftrage der Generalverwaltung, durch A. Bastian und A. Voss. Berlin, Weidmannsche Buchhandlung, 1878." This elegant quarto contains xvi, 79 pages of text, and 16 plates, in which are 281 photolithographic figures. Although the title is "bronze-swords," the drawings and descriptions include arm-ornaments, axes, buckles, plates, amber, celts, batons, daggers, iron, ivory, leather, fibulæ, vessels, gold, girdle, neck-ornaments, resin, wood, horn, clappers, boxes, spear-points, knives, needles, chapes, palstave, beads, arrow-points, tweezers, sconces, bucklers, keys, sword-hilts, spirals, pottery, urns and tongs. The localities from which the objects come are the different States of the German Empire, Denmark, Sweden, Austro-Hungary, Italy, Greece, Turkey and Egypt.

To each plate a chapter is devoted, in which the separate objects are described minutely, and the catalogue number and museum indicated.

In the introduction, Professor Bastian gives an excellent résumé of studies on the Bronze-age with copious references to authorities. On the whole, this is one of the most comprehensive and thorough archæological monographs we have seen for many a day.

Anthropology in Great Britain.—The August number of the Journal of the Anthropological Institute commences Vol. x. The original communications cover a variety of subjects, all of which are of general interest. Their titles are as follows:

On the Central South African Tribes from the south coast to the Zambesi. By Dr. Emil Holub.

Notes on the Western Regions. Translated from the "Tsēĕn Han Shoo," Book 96, Part 1. By A. Wylie, Esq.

On the origin of the plough and the wheel carriage. By E. B. Tylor.

Visualized numerals. By Francis Galton.

On Nicobarese ideographs. By V. Ball.

Notes on the Polynesian races. By C. Staniland Wake.

The paper of Dr. Holub is a description of personal adventures among the Bushmen, Hottentot, and Banthu tribes, and is illustrated with plates from his work, "Seven Years in South Africa," published by Sampson Low and Marston.

The Notes on the western regions are translations from ancient Chinese records of references to Asiatic nations lying to the west of them.

Mr. Tylor's communication on the plough and the wheel carriage has already appeared in *Nature*, as well as Mr. Galton's upon visualized numerals.

The paper which will be most carefully and widely read, perhaps, is that of Mr. Wake. Therein the author proposes "to show, first, that the Polynesian islanders must be described rather as a bearded than a non-bearded race, and, second, that, as a rule, they are well acquainted with the use of the bow and arrow." He also proposes to substitute for *Sawaiori*, of Whitmee, *Malayo-Polynesians*, of Humboldt, or *Mahori*, of Ranken, the word Rănākā, it being the universal expression for "man" throughout the Polynesian groups.

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GEOLOGY AND PALÆONTOLOGY.

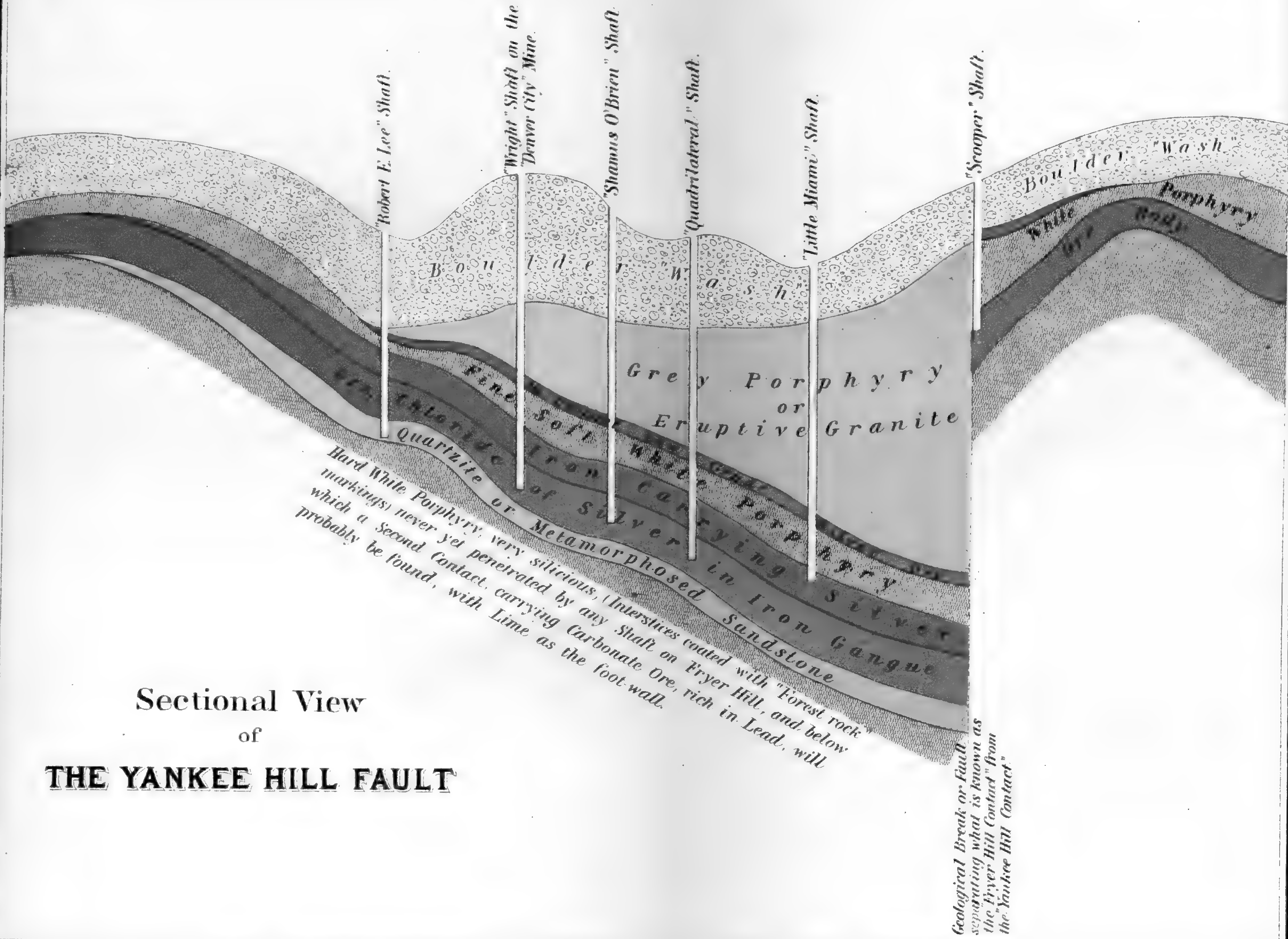
MAMMALIA OF THE LOWER EOCENE BEDS.—As stated in my report to Lieut. Wheeler in 1877, no vertebrate remains have been found in the Puerco beds, which underly the Wasatch in New Mexico, up to the present time. It was therefore uncertain whether they form the top of the Cretaceous or the bottom of the Tertiary series. I have recently obtained evidence of the existence of *Mammalia* and turtles in them, so that their position is probably in the Tertiary division, as already suspected by Dr. Endlich and myself. Two species of flesh-eaters recently received from beds that may prove to belong to the Puerco group, do not belong to genera hitherto known from the Wasatch. The one which I first describe is of considerable interest as representing a very primitive type of carnivorous dentition.

Periptychus carinidens, gen. et. sp. nov. Creodontium. *Char. Gen.* No distinct sectorial teeth, the first and second true inferior molars similar. They support a principal median cusp, a broad heel and a prominent anterior cingulum. The heel is more or less divided into tubercles; the anterior cingulum is on the inner side, and represents the anterior cusp of a sectorial tooth. On the inner side of the principal cusp a cingulum rises, forming a flat internal tubercle. Last molar not smaller than the others; premolars unknown.

This genus belongs to the *Amblyctonidæ* with *Amblyctonus* and *Palæonyctis*. It differs from both in the rudimental character of the anterior cusp, and from the former, in the presence of the internal tubercle. In *Mesonyx* the heel has a median cutting edge. *Char. Specif.* Parts of both mandibular rami and the shaft of a humerus represent this species. They indicate an animal of the size of the red fox, but much more robust. The mandibular ramus is rather shallow and thick, and the molars are not large. The heel of the penultimate supports three tubercles, of which the external is the largest. The anterior cingulum supports a small cusp, and then rises to the internal tubercle, which is compressed. The sides of all the cusps are marked with distinct, well separated, vertical ridges. Each extremity of the internal cusp is connected with the principal cusp by a ridge. The first true molar has fewer cusps. Those of the heel are scarcely distinct, and form a border which rises prominently into the flat internal tubercle, which forms a narrow longitudinal blade. The anterior cingulum has no cusp and does not rise into the inner tubercle. The principal cusp has a strong entering groove next the inner tubercle. Length of crown first molar, .0115; width of do., .006; elevation of do., .006. Length of second molar, .011; width of do., .007; elevation of do , .0065. Depth of ramus at do., .020. The species is a good deal smaller than the *Amblyctonus sinosus*.

Deltatherium fundaminis, gen. et sp. nov. *Char. Gen.* Fam. *Leptictidæ*, agreeing with *Ictops* and *Mesodectes* in possessing an internal tubercle of the third superior premolar, but differing from both in having but one external cusp of the fourth superior premolar. *Char. Specif.* Represented by the dentition of both maxillary bones minus the canines. The second premolar is convex on the inner face. The base of the third is a nearly equilateral triangle. The bases of the true molars are triangles, with the bases external. The internal angle supports an acute cusp, and has a posterior basal cingulum, which is very strong in the last three molars. The two external cusps of the first and second molars are situated well within the base, which is folded into a strong cingulum. This cingulum develops strong anterior and posterior angles. This is the largest species of the family yet discovered. Extent of series of last six molars, m. .045; of true molars, .026; diameters of fourth premolar, anteroposterior, .0074; transverse, .0076; do. of second true molar, anteroposterior, .0087; transverse, .0100. This species was a fourth larger than the common opossum, and very much resembles it in dental characters. —*E. D. Cope.*

THE FAULT OF THE YANKEE HILL SILVER DEPOSIT OF LEADVILLE, COLORADO.—The formation on the surface of Fryer Hill and adjoining hills east of Leadville, Colorado, consists of an uncommonly deep "wash," of boulders embedded in earth, varying from 150 to 175 feet in depth. Immediately under this wash we encounter a dark gray eruptive or porphyritic granite. This porphyritic granite varies from twenty feet, in the Denver City discovery shaft, on the west, to nearly if not quite four hundred feet in thickness in some of the claims adjoining the property to the east; and the dip is quite uniformly north north-east, although at the Denver City discovery shaft, a local wave causes the ore body to dip slightly to the west. Under this gray porphyritic granite a low grade deposit has invariably been encountered by all of the shafts which have so far penetrated through it, which consists principally of a clayey mass varying from five to twenty feet in thickness, with small bodies and stringers of low grade silver ore interspersed through it. So far I have not learned of any ore being found in this deposit which has assayed over five to forty ounces, although it has been penetrated at nearly a dozen different points in this section, viz: in the Denver City discovery shaft, in the Shamus O'Brien, in the Little Miami, the El Paso, the Tip Top, the Little Sliver, the Compromise and other shafts which I will not occupy space in enumerating. To the west of a line drawn through the Little Sliver and Denver City discovery shafts the main contact comes so much nearer the surface that these overlying formations have undoubtedly been scored off by glacial action. This is plainly evident at points in the Lee, the Little Pittsburgh and the New Discovery claims, where the excoriation has cut down clear through the white porphyry and iron and left the boulder wash lying upon the silver-bearing iron itself.



Sectional View
of
THE YANKEE HILL FAULT

Under the low grade ore bed just described, comes in a soft, white feldspathic porphyry, which in this vicinity usually averages about fifty feet thick, although I know of a point about one mile east, where it was found to be over two hundred feet thick. This white porphyry lies immediately above the iron with which and in which the ore bodies are found. A study of the accompanying diagrams will aid in gaining a clear idea of the lay of the different formations.

Enough development has already been accomplished at numerous points to prove that the ore body uncovered in the Denver City discovery shaft belongs to the Fryer hill deposit, and it is equally certain that such ore deposit with a few local waves, and also possible slight faults, continues in a practically unbroken dip from the extreme western workings of the Chrysolite group, in an easterly direction for a distance of over four thousand feet, to the well defined geological break or fault (of at least four hundred feet slip) which gives rise to what is commonly known as the "Yankee Hill Contact." This break corresponds very nearly to the fault which separates Carbonate hill from Iron hill, and which fault is better understood, as the foot wall of the ore bodies on those hills is a heavy ledge of limestone undoubtedly in place; whereas the foot wall of the present Fryer hill bodies is generally a layer of true quartzite, or metamorphosed sandstone, which in turn lies upon a hard white, silicious porphyry, similar to that which overlies the whole of the Carbonate and Iron hill ore bodies. In places this quartzite is wanting, in which case the mineral lies upon the hard white porphyry. This porphyry has not yet been passed through by any of the shafts so far sunk upon Fryer hill, and what underlies it is still an unsolved problem. I will venture to predict, however, that other and possibly larger ore bodies than those now being worked are yet to be found in place, with lime as a foot wall, under this porphyry; and such bodies will probably also be richer in lead, if not in silver, as is the case with the ore bodies found on lime in other portions of the camp. This, at least, is a matter which should be proved by sinking one or more shafts on Fryer hill to the granite bed rock.—*W. G. Shedd.*

FILHOL ON PROÆLURUS.—Mr. H. Filhol has recently published a monograph on this genus in the Society of Physical and Natural Sciences of Toulouse, illustrated by five plates. *Proælurus* was discovered by Mr. Filhol, and the remains of three species occur in the upper Eocene of Quercy, and the lower Miocene of St. Gerand le Puy. The discovery, at the latter locality, of a nearly perfect skeleton of the *P. lemanensis*, gave rise to the present memoir. Mr. Filhol shows that in this genus, the foramina of the base of the skull characteristic of the *Nimravidæ* and *Cryptoproctidæ*, are all present. These are the two alisphenoids, the postglenoid, and the distinct carotid and condyloid. These foramina were all assigned to *Procælurus* by inference, prior to their discovery, in the article on the extinct cats of America in the December, 1880, number of the NATURALIST, and the genus was therefore referred to the *Nimravidæ*. Mr. Filhol, however, shows that there are five toes on all the feet instead of five and four, so that *Procælurus* must be referred to the *Cryptoproctidæ*. A detailed comparison gives the resemblances and differences between the *P. lemanensis*, and the *C. ferox*. In this memoir we have another interesting contribution to the history of the types of the Eocene fauna whose representatives yet remain in the southern hemisphere.

THE CLASSIFICATION OF THE PERISSODACTYLA.—In the forthcoming Report of the U. S. Geological Survey of the Territories of Dr. Hayden, the following arrangement is given by Professor Cope.

I. Anterior exterior crescent of superior molars shortened and connected with an anterior basal lobe; inferior molars with cross-crests; premolars different from molars.

1. Toes 4—3 .... *Lophiodontidæ*.
2. Toes 3—3 .... *Triplopodidæ*.

II. Anterior exterior crescent of superior molars like div. I; inferior molars with cross-crests; superior molars and premolars alike, with cross-crests.

3. Mastoid bone forming part of the external wall of the skull; no postcotyloid tuberosity of the mandible; neck elongate .... *Hyracodontidæ*.
4. Mastoid bone excluded from the walls of the skull by the contact of the occipital and squamosal; a postcotyloid tuberosity of the mandible; neck short .... *Rhinocerontidæ*.

III. Exterior crescentoid crests of superior molars subequal; inferior molars with cross-crests.

5. Superior molars and premolars alike and with cross-crests .... *Tapiridæ*.

IV. The external crescentoid crests of the superior molars subequal; inferior molars with crescents.

A. Premolars different from molars; the superior with only one internal cusp.

6. Toes 4—3 .... *Chalicotheriidæ*.

AA. Premolars like molars, with two internal lobes above.

7. Toes with digits 4—3 .... *Palæotheriidæ*.
8. Toes with digits 3—3 .... *Anchitheriidæ*.
9. Toes with digits 1—1 .... *Equidæ*,

GEOLOGICAL NEWS.—Professor Huxley evidently believes in American palæontology. He is still lecturing on our fossil horses, concerning which he apparently has information not generally accessible to American palæontologists. He has expressed the opinion that the primitive mammalia were five-toed, after it had been announced in this country, and he has recently discovered that the *Insectivora* represent a primitive type of mammalia. This view was proposed here six years ago, long enough ago for Professor Huxley to have forgotten where the idea originated.——Professor Wilder in *Science*, suggests that the large sacral neural cavity found by Marsh in *Hypsirhophus (Stegosaurus)*, was not filled by nervous matter. This view has doubtless occurred to most persons familiar with the anatomy of the *Batrachia* and *Reptilia*. ——Professor T. S. Hunt has recently published an account of the mineral products of the Hocking valley, Ohio.——Mr. J. W. Hulke, in the London Geological Society Journal for August, 1880, describes in detail the new *Iguanodon prestvichii* from the Kimmeridge clay from near Oxford, England. He shows that in this genus, the second row of tarsal bones is articulated with the metatarsals, as in birds.

GEOGRAPHY AND TRAVELS.[1]

VOYAGES IN BEHRING STRAIT IN 1880.—The U. S. revenue steamer *Corwin*, Captain C. L. Hooper, was sent early in the summer of 1880, to the Strait of Behring, to ascertain the fate of the two whaling vessels lost in the ice in the autumn of 1879, and also to endeavor to communicate with the exploring steamer *Jeannette*. She made three trips into the Arctic Ocean through Behring Strait. Herald Island was sighted several times and found to be surrounded by ice. The *Corwin* approached to within seven miles of the land, but was stopped by ice from twelve to forty feet thick. Captain Hooper thinks the ice around the island was old; that for two or three years at a time it does not leave the island free, and rarely breaks up between Herald Island and Wrangell Land. The perpendicular sides of Herald Island must render it inaccessible to all but the birds of the air, and no signs of life were visible.

The *Corwin* reached Point Barrow on August 25th. "On the 11th of September," Captain Hooper's report continues, "we saw the high hills of Wrangell Land, bearing west one-quarter east (true). We ran in toward it until we came to the solid pack, the ice having the same general appearance as that we had previously encountered in the vicinity of Herald Island, except in being covered with newly fallen snow, and being, consequently, white. We judged the land to be about twenty-five miles away. The highest hills, which seemed to be more distant, were covered with snow; others were partly covered, and still lower ones were almost entirely bare. The sight of this land repaid us to a certain extent for our disappointment in not finding Herald Island clear of ice as we had hoped to do in order that we might run lines of soundings and make a plan of the island. That part of Wrangell Land which we saw covered an arc of the horizon of about 50°—from N. W. ¼ N. to W. ¼ S. (true)—and was distant from twenty-five miles on the former, bearing to thirty-five or forty miles on the latter. On the south were three mountains, probably 3000 feet high, entirely covered with snow, the central one presenting a conical appearance, and the others showing rounded tops. To the northward of these mountains was a chain of rounded hills, those near the sea being lower and nearly free from snow, while the

[1] Edited by ELLIS H. YARNALL, Philadelphia.

back hills, which probably reach an elevation of 2000 feet, were quite white. To the north of the northern bearing given, the land ends entirely or becomes very low. The atmosphere was very clear, and we could easily have seen any land above the horizon within a distance of sixty or seventy miles, but none could be seen from the masthead."

Captain Hooper considers it doubtful if Wrangell Land is ever free from ice. The immense body of warm water which is constantly passing through Behring Strait into the Arctic is carried to the east along the shore of the American Continent, and does not pass within two hundred and fifty miles of Wrangell Land. "I believe, however that it is possible, at times, for a strong vessel, properly equipped and fitted, to work her way in shore far enough to reach a safe harbor among the grounded ice within easy traveling distance of the land, where she could remain in safety, and exploring parties be sent out to examine the land. I am of the opinion that Wrangell Land is a large island, possibly one of the chain that passes entirely through the polar regions to Greenland. That there is other land to the northward there can be no doubt.

"Captain Keenan, then commanding the bark *James Allen*, reports having seen land to the northward of Harrison's Bay, a few degrees east of Point Barrow. He was boiling out, and stood north under easy sail, during thick weather, eighty or ninety miles. When the fog lifted high land was visible to the northward, a long distance away but perfectly distinct. Large numbers of geese and other aquatic birds pass Point Barrow going north in the spring, and return in August and September with their young. As it is well known that these birds breed only on land, this fact alone must be regarded as proof positive of the existence of land in the north. Another reason for supposing that there is either a continent or a chain of islands passing the polar regions, is the fact that notwithstanding the vast amount of heat diffused by the warm current passing through Behring Straits, the icy barrier is from $6\frac{1}{2}^{\circ}$ to 8° further south on this side than on the Greenland side of the Arctic Ocean, where the temperature is much lower. The Tchukches have a number of legends in regard to some of these people having left the mainland and crossed over the ice to a 'great land' further north; and also of herds of reindeer having crossed over from the north. There may or may not be foundation for these legends.

"To attain a high latitude with a vessel in this part of the Arctic is impossible. The whalers follow the ice-pack very closely between Herald Island and Point Barrow, and never have been able to reach the seventy-fourth degree of latitude as yet, while only one or two claim to have been as far north as 73°. In the Greenland seas, on the contrary, it is no uncommon thing for whalers to reach the seventy-eighth degree, or even higher.

From what I can learn from the accounts of those who have traveled in other parts of the Arctic, and from my own observations, I believe that nowhere else within the Arctic Circle does ice remain permanently so far south as between Wrangell Land and Point Barrow."[1]

No traces of the missing whalers were found and there can be no doubt that they and their crews perished in the pack.

Mr. W. H. Dall, of the U. S. Coast Survey, continued his explorations in Alaska and the northern coast of America during the past season, being accompanied by Dr. Bean, who has also been making the zoölogical collections in this region for a number of summers, for the U. S. Fish Commission.

After visiting the inland waters of British Columbia and Alaska, they arrived at Sitka and proceeded thence along the coast to Cook's Inlet, westward to Unalaskha, and northward through Behring Strait along the American coast to the Seahorse Islands, not very far west of Point Barrow, where the ice barred their way. Forty-two stations were occupied during the season for astronomical, magnetic, meteorological and hydrographical observations.

A hydrothermal section of Behring Strait was made, which Mr. Dall states confirms his previous suspicions that there is no southerly Polar current through these straits, and that the existing currents are dependent chiefly on the tides. The warm northerly current through the straits is chiefly derived from the shallow sounds and large rivers of the adjacent American coast, and is warmer than any water found south of St. Lawrence Island, at the southern entrance to the strait.[2]

The boundary line between Russia and the United States is found to pass between the Diomede Islands, as stated in the treaty. An immense "dead" glacier was observed on the northwest shore of Yakutat Bay, near the foot of Mount St. Elias. The feeders of this great ice-field, which covers perhaps seventy-five square miles, are so shrunken by the more milder climate, that the mass now lies as a great plain or table-land, without motion, and covered with detritus, which preserves it from the heat of the sun. A careful examination was also made of another most remarkable ice phenomenon in Kotzebue Sound, visited by Kotzebue, Beechey, and the officers of the *Herald*, whose

[1] It may here be noted that the general experience of navigators north of Behring Strait has been that the early part of the summer season is the only time Herald Island or Wrangell Land can be approached. The action of the warm current from the Pacific is quickly felt on the ice fields south of latitude 71°, and west of longitude 173°, so that a barrier of rotten ice brought by the southerly and easterly drifts of the opposing polar current that flows along the eastern side of Wrangell Land, stretches from Cape Serdze on the Asiatic coast to Cape Krusenstern on the Alaska shore. If this barrier is penetrated the sea is found to be comparatively free of ice until the limit of the great northern ice field is reached. In the latter part of July vessels are able to approach very near to Herald Island, but later the advance of the great northern pack causes it, as well as Wrangell Land, to be unapproachable.—*Editor.*

[2] These results are surprising; it having heretofore been generally believed that a considerable portion of the great equatorial current of the Pacific, the Kuro-Sivo, passed through the strait, and they invite the careful examination of geographers.—*Editor.*

wooden record, standing since 1826, was found in good preservation on Chamisso Island. This consists of a mountain of pure ice, covered with a non-conducting layer of moss, vegetable matter and clay, of the period when the wild horse, buffalo and mammoth, frequented this region. Their bones are abundant and have been figured by Seeman, in the zöology of the *Herald.* The ice attains an elevation much beyond any hills or rock-formation visible from its summit, and is interstratified like a rock with the clays, etc. It is pure, except on the surface, has no glacial débris about it, and is devoid of motion. The cliffs rise at the sea front to perhaps one hundred feet, and the hill of ice of which these cliffs form the face, attains six hundred or eight hundred feet, a few miles inland, entirely overlooking all the rock-formations of the vicinity. Mr. Dall considers it impracticable to refer it to glacial action, properly so called. It extends north to Point Barrow, and East to Return Reef on the northern coast, but is not continuous, and is absent in the rocky, elevated parts, as for instance, about Cape Lisburne.

The zöological collections made during the past season include several birds and many fishes new to the region, as well as a smaller number probably new to science. Ethnological material was largely obtained, and it was remarked that the proper name of the people on the Asiatic side, described by Nordenskiöld and his companions, and previously by Hooper and Mr. Dall, is Yū′-it, a corruption or shortening of In-ñū-it (Eskimo), of which they merely form one tribe. They are totally distinct in language, race and manners from the so-called Reindeer Tchukches (Tsau′-yū-at), who are a mere tribe of the Korak nation.

Mr. Dall maintains that these Asiatic Eskimo are comparatively modern immigrants from America. The change of population is constantly going on; only last summer a new colony from Behring Strait settled at Cape Olutorsk, and more will go this year to join them. Internal hostilities and the want of food are the causes. Two winters ago several hundred of American Eskimo perished from starvation on St. Lawrence Island. The destruction of walrus by the whale ships during the scarcity of whales has had much to do with it; and the trading of liquor from the Sandwich Islands, keeping the people drunk when they should be laying up a winter store, is another.

Lake Tanganyika.—Mr. E. C. Hore writes from Ujiji to the Royal Geographical Society[1] regarding the still unexplained phenomenon of the long-continued rise of the waters of this lake, and the reopening of the Lukuga outlet, which he was the first to witness two years ago, that the reports at Ujiji "go to show that when Cameron was here a marked rising of the lake waters had already been observed, and that it continued from that time up to about two years ago, when the surface was eight feet higher than in Cameron's time. From that date (*i. e.* two years ago), I

[1] Proceedings R. G. S., January, 1881, p. 41.

have observed that the waters are gradually retiring, and this at a very regular rate, except during the rains (when, however, there is no rise). Three months ago the Arabs agreed in telling me, '*Now* the lake is the same as when Cameron was here.' The partly submerged palm-tree on which I had fixed a water-gauge, was then just left dry, and the Arabs told me that Cameron used this tree as a target and that it was then just at the water's edge. Now, all the observations and the reports I hear lead me to believe that the lake has been gradually rising for years, and that it rose until it burst open the Lukuga obstruction, first oozing through in small quantities as when seen by Cameron. That the waters should now rush through the Lukuga instead of gently overflowing is probably due to the first burst having eroded a deeper channel; for, according to the geological nature of the Lukuga gap, so will the waters cut a deeper and deeper chasm, or eventually find a permanent level and gently flow over a rocky sill. I cannot think that there could have been, just before the late bursting of the Lukuga, any more than a mere trickle of water through the obstruction there, and that of periodical occurrence, and of but small amount as a drainage of the lake. But what is still unaccounted for is this: before the time of Cameron's visit this periodical rising must have been infinitesimal, if any, compared with that of the few years immediately preceding the bursting of the Lukuga, or we must do away with the ancient character of the lake. I am convinced that the lake never (or, at any rate, for very many years), was at such a height as it was two years ago. This is quite apart from any geological evidence of a different state of things in remote ages. And I cannot believe that the lake has always been rising at this rate. Now, how is it that this enormous quantity of water could rise so quickly in spite of that evaporation which has (as is supposed) been sufficient for ages to maintain it almost at a level. A succession of extraordinary rainy seasons, of which we have no evidence, would not account for it. I can bear testimony to an enormous *evaporation*, but how is it that the waters suddenly gained upon the evaporation as they had never done before?"

Mr. Hore seems disposed to connect the changes of water-level with earthquake movements. Earthquakes were occurring at the time of writing (September 13th, 1880). One of the Arabs stated that some years previous an extraordinary disturbance of the lake waters occurred; a long line of broken water being seen, like a reef, bubbling and reeking with steam. The next morning all was tranquil, but the shore was strewn with masses of a substance resembling bitumen, specimens of which Mr. Hore had secured to bring with him to England. An excellent map of the southern end of the lake has been made by Mr. Hore. Latitude by stars N. and S. was observed at twelve different places, and the coast line between them laid down by compass bearings.

MICROSCOPY.[1]

A New Fine Adjustment.—Mr. Ernst Gundlach, of Rochester, has introduced a device by means of which an extremely slow, fine adjustment can be obtained in addition to the ordinary coarse screw movement. It is described as follows:

In working high powers, microscopists have felt the need of a finer adjustment than the ordinary micrometer-screw, which cannot be made much finer and still be durable enough. This need is now supplied by the combination of two screws which give a resultant motion equal to the difference in the threads employed. One of these screws is a little coarser than the ordinary micrometer screw, and may be used alone as a fine adjustment, and a change can be made instantly from this to the finer motion. Either is given by one milled head located in the usual position of the fine adjustment screw-head on Gundlach's microscopes, and the change is made by turning a smaller clamping screw having its head over the former. By tightening the clamping screw, the adjustment is in order for the work of the combination; by loosening, for that of the coarser screw only. As the thread of this is a little coarser than the ordinary micrometer screw, it alone gives a better motion for medium powers than the fine adjustment in common use, a second advantage of the invention.

New Method of Dry Mounting.—Mr. Frank French has contributed to the Postal Microscopical Club, a slide mounted in a style which promises to be useful for certain kinds of opaque objects which will bear occasional exposure to the dust and moisture of the air, and which are best viewed without the intervention of a cover-glass. The slip is composed of cardboard cut to 3 × 1 inches, the required thickness in each case being attained by building up a sufficient number of thicknesses, gummed together. The centers are punched out as from the paper covers for glass slips; and the object is fastened at the bottom of the cell thus formed, either upon mica fastened at the bottom of the cell or upon a bottom card not punched like the rest. The object is covered by a rectangular brass sliding plate below the upper card, the card next below being cut away to receive it and to allow it room to slide entirely away from sight when desired. A pin head is riveted and soldered into this brass plate, and projects through the upper card, appearing near the right end of the finished mount, through a longitudinal slot that permits it to be pushed toward or from the other end of the slide, and thus to carry the brass plate over the object or away from it. The whole mount is finished by covering with paper in the old style.

Mounting in Copal Varnish.—I find this varnish dries very rapidly if slightly heated, or even if placed on a previouly-warmed slide. I have many hundred slides of diatoms prepared in copal varnish, and my friend, Mr. Van Heurck, of Antwerp, who was

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

the first to use this material, has many thousands. The varnish to be used is what is called the "pale copal," and its consistency ought to be that of oil. It is much pleasanter to use than Canada balsam, does not make bubbles, and its refractive index is not very different from that of balsam, and does not interfere with the solution of diatom markings. I have of late made many preparations in copal, dispensing with the cover-glass altogether. The drop of copal is placed on the diatoms and heated lightly over the spirit-lamp. It soon takes the consistency of amber, and is hard enough to sustain wiping and brushing with a soft brush with impunity.—*Julien Deby, C. E., from the Journal of the Queckett Microscopical Club.*

IMPORTANCE OF STATING MAGNIFYING POWER USED.—Mr. F. J. George very properly protests, in *Science Gossip*, against the vague and ambiguous phraseology used in connection with the magnified sketches of microscopic objects. Drawings which are lettered "highly magnified," "much enlarged," etc., are rendered unscientific and absurd by the very words thus used to explain them. It would be more rational, more instructive, and more satisfactory to every scientific reader, if such vague statements were replaced, in every possible instance, by a memorandum of the number of diameters by which the drawing surpasses the size of the natural object.

COLUMBUS, OHIO, MARCH 1, 1881.

EDITOR AMERICAN NATURALIST:

Dear Sir:—I am authorized by the president of the American Society of Microscopists to announce to its members, that the Executive Committee have decided by an almost unanimous vote, to accept the invitation received from Columbus, Ohio, and to call the next meeting of the society at that place, on Tuesday, August 9, 1981 (the week previous to the Cincinnati meeting of the American Association for the advancement of Science).

ALBERT H. TUTTLE, *Secretary.*

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SCIENTIFIC NEWS.

— From advanced sheets of the report of Professor W. K. Brooks, Director of the Chesapeake Zoölogical Laboratory of Johns Hopkins University, we learn that by the liberality of the Trustees he was enabled to spend a much longer period than hitherto at the seaside, and was provided with a more liberal outfit, including a steam launch which was built for their use in the last spring, at Bristol, R. I., and has proved a very efficient auxiliary. The necessary books, dredges and other instruments were also provided by the University. In addition to the opportunities afforded to three of the members of their own academic staff, three other gentlemen, devoted to the study of zoölogy, were invited to avail themselves of the scientific facilities of the station.

The laboratory was opened at Beaufort, N. C., on April 23, 1880, and closed on September 30, after a session of twenty-three weeks. It was supplied with working accommodations for the six investigators who were in attendance.

Beaufort was selected for the third season's work because it is the nearest accessible town, south of Baltimore, which is favorably situated for zoölogical study. The advantages of a location in a town are well shown by the fact that the expenses of a session of twenty-three weeks this year were considerably less than those of a ten weeks' session the year before.

The scientific advantages of Beaufort are very great; the most important is the great difference between its fauna and that of our northern Atlantic coast.

The configuration of our coast line is such that Cape Hatteras, the most projecting point south of New York, deflects the warm water of the Gulf Stream away from the coast, and thus forms an abrupt barrier between a cold northern coast and a warm southern one. The fauna north of this barrier passes gradually into that of Southern New England, while the fauna south of the barrier passes without any abrupt change into that of Florida, but the northern fauna is sharply separated by Cape Hatteras from the southern.

During the past season Dr. Brooks worked out the interesting life history of Leucifer, and Mr. Wilson that of Phoronis, which have been published in abstract in the NATURALIST.

Another interesting group which was studied is the Porcellanidæ; the least specialized of the true crabs. The adults of our American species are almost restricted to our southern waters, although the swimming larvæ are carried north by the Gulf Stream. Within the last two years two northern naturalists have studied these floating embryos upon the south coast of New England, but as they were working upon stragglers so far from home, their accounts are incomplete and somewhat contradictory. The advantages at Beaufort enabled them to contribute towards the solution of this confused subject by raising one species of Porcellana from the egg.

They also raised six other species of crabs from the egg, and made drawings of the more important stages of development. One of the species which was thus studied is the edible crab. Its metamorphosis has never been figured, and although it presents no unusual features, its economic importance gives value to exact knowledge of its life history.

Mr. Wilson also studied the development of one species of Pycnogonida, a group of very peculiar Arthropods, distantly related to the spiders. As he has paid especial attention to the systematic study of this group, and is now engaged in describing the Pycnogonids collected in the Gulf Stream by Mr. Agassiz, the opportunity to study them alive in the laboratory has been a great advantage to him.

Another important investigation is the study, by Mr. Wilson, of the embryology of the marine Annelids. Although the representatives of this large group are abundant and widely distributed, little was known of the early stages of their development until he procured the eggs of several species and studied them at Beaufort. This investigation has shown, among other things, that the accepted division of Annelids into two great groups, the Oligochæta and Polychæta, is not a natural method of classification. The work upon the development of marine Annelids was supplementary to an investigation which Mr. Wilson carried on last spring at Baltimore, and which he will continue this winter, upon the development of land and fresh-water Annelids.

As much time as possible was given this season to the study of the hydroids and jelly-fish of Beaufort. The life history of several of them were investigated, a thorough anatomical study of some of the most important forms was carried on, and nearly two hundred drawings were made. It is almost impossible to complete a study of this kind in a single season, but if one or two more summers can be given to the work, we have every reason to hope for valuable results, for although the North Carolina coast is the home of many species which are only found as stragglers upon our northern coast, and of other species which are not known to occur anywhere else, and of some genera and families which are new to the North American coast, this field has suffered almost total neglect.

Nearly three months of the time of two members of the party, Mitsukuri and Wilson, were given to the study of the habits, anatomy and development of Renilla, a compound Polyp very much like that which forms the precious coral, but soft and without a stony skeleton. The animals which form the community are so intimately bound together that the community, as a whole, has a well marked individuality, distinct from that of the separate animals which compose it. The compound individuality of Renilla is quite rudimentary as compared with that of a Siphonophore, and as there is no trace of it in the closely allied Gorgonias, it furnishes an excellent field for studying the incipient stages in the formation of a compound organism by the union and specialization of a community of independent simple organisms. With this end in view the anatomy of the fully developed community was carefully studied, and the formation of a community was traced by rearing a simple solitary embryo in an aquarium until a perfect community had been developed from it by budding. During the process of development the law of growth by which the characteristics of the compound organism are brought about was very clearly exhibited, and it is fully illustrated by nearly one hundred drawings.

Next summer there will be room at the laboratory for ten instead of six students. The nature of the results of this and the first and second seasons' work of this laboratory certainly show that scientifically the success is all that could have been expected; and we may expect that if the institution is permanently maintained by the Trustees of the University, the results will be most creditable to American Biological Science. This department is not strong in the United States, and if the Johns Hopkins University can permanently aid in its development, with officers and students so ready to avail themselves of the privileges offered, it is to be hoped that the question of a few hundred dollars will not be an obstacle to the success of the undertaking.

— A bill establishing a Bureau of Animal Industry was reported to the Senate in February by Mr. Johnson, from the select committee on the subject of pleuro-pneumonia and other contagious diseases of domestic animals. It provides for the organization of a bureau of animal economy in the Department of Agriculture. It authorizes the Commissioner of Agriculture to appoint a Chief of this Bureau, who is a competent veterinary surgeon, approved by the National Board of Health, and whose duty it is to investigate and report the value and condition of domestic animals, and also the cause of contagious diseases among them, and provide for the prevention and cure of the same. The Commissioner is authorized by the bill to purchase and slaughter diseased animals, provided the sum paid for them shall not exceed two-thirds the market value of healthy animals, and $200,000 is appropriated to meet the expenses incurred in carrying out the provisions of the act.

— Major J. W. Powell was, a few days ago, confirmed by the Senate to fill the position of Director of the United States Geological Survey, recently vacated by Mr. King. While our preferences are for Dr. Hayden, the founder of the survey, we will hope the new occupant may be sustained by liberal congressional appropriations.

— Dr. James Lewis, the celebrated conchologist, died on the 23d February last, at his home in Mohawk, N. Y. His malady was one of long standing, and during the later years of his life caused him much suffering. Well known to most conchologists in the United States, the intelligence of his death will be received by them with deep regret. A brief sketch of his life will appear in another number.—*R. E. C.*

— On the 3d of February died the well-known English ornithologist, John Gould, F. R. S., aged 76. He was the author of "A Century of Birds from the Himalaya mountains;" "The Birds of Europe," and "The Birds of Australia," the latter in seven folio volumes and with colored illustrations of 600 species, and many other important works. He had been recently engaged on an entirely new work, "The Birds of Great Britain."

— Lithology has suffered a loss by the death of Professor Emanuel Boricky, who died in January last at Prague, aged 40 years. He was well known for his studies on the rocks and minerals of Hungary and Austria.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Boston Society of Natural History, Feb. 16.—Dr. C. S. Minot discussed the question of a common larval type among annelids, mollusks and vertebrates. The president spoke of the carboniferous insects of Great Britain, and Mr. Burgess remarked on the aorta in the Lepidoptera.

March 2.—Mr. Lucien Carr read a paper on sun worship among the North American Indians, and Dr. M. E. Wadsworth one on the history of Prepaleozoic geology in New Brunswick.

New York Academy of Sciences, Jan. 31.—Papers were read by Mr. B. B. Chamberlain, entitled, Studies in local mineralogy—1. A singular mineral identified; 2. Iron-coated boulders from Brooklyn; 3. The gneiss of New York island; and by Professor Newberry on our coast corals, their relations and geological work (with specimens and lantern illustrations).

Feb. 7.—Mr. A. A. Julien made a communication on the gneisses and diorites of the Greensboro' belt, North Carolina.

March 7.—Mr. G. F. Kunz described the spodumene emerald of North Carolina (Hiddenite), and exhibited specimens.

American Geographical Society, Feb. 17.—Mr. John Banvard delivered a lecture on the hierology and reading of the obelisks of Egypt, illustrated by charts, diagrams and paintings on canvas, executed from original drawings made by himself while in Egypt.

Appalachian Mountain Club, Feb. 9.—Mrs. Maria E. McKaye read a paper on Lake Dunmore.

State Natural History Society, Feb. 8.—The second annual meeting was held in the State House at Springfield, Illinois. President Worthen addressed the society on the fossil fuels of the United States. Papers and remarks on the archæology of Illinois, especially the mound-builders, were communicated by Mr. W. McAdams, Judge J. G. Henderson, Professor Cyrus Thomas and others. Mr. McAdams then read a paper on artesian wells. Mr. F. S. Earle described the cave-dwellers of Southern Illinois. Mr. W. H. Garman presented the results of studies on the gall mites (Phytopti). Professor C. Thomas remarked on the Palenque tablets. Professor Burrill discussed the subject of *Bacteria pe-menta*. Mr. D. B. Wier contributed a paper on the grape rot; while Professor Forbes read a paper entitled illustrations and application of the doctrine of evolution. Judge Henderson delivered an address entitled, The ancient Illinois, and finally Professor Forbes read a paper on the English sparrow in Germany, with notes on its autumnal food in Illinois.

SELECTED ARTICLES IN SCIENTIFIC SERIALS.

AMERICAN JOURNAL OF SCIENCE AND ARTS.—March. Structure and affinities of Euphorberia of Meek and Worthen, by S. H. Scudder. Origin of some new points in the topography of North Carolina, by W. C. Kerr.

THE GEOLOGICAL MAGAZINE.—February. The glaciation of the Shetland isles, by B. N. Peach. Oceanic islands, by T. M. Reade.

ANNALS AND MAGAZINE OF NATURAL HISTORY. — January. *Spolia atlantica,* Contributions to the knowledge of the changes of form in fishes during their growth and development, especially in the pelagic fishes of the Atlantic, by C. F. Lütken (continued in the February number).

BULLETIN OF THE U. S. GEOLOGICAL SURVEY OF THE TERRITORIES.—Vol. VI, No. 1, Feb. 11. The vegetation of the Rocky Mountain region, and a comparison with that of other parts of the world, by A. Gray and J. D. Hooker. On some new Batrachia and Reptilia from the Permian beds of Texas. On a wading-bird from the Amyzon shales, by E. D. Cope. Osteology of *Speotyto cunicularia* var. *hypogæa*, by R. W. Shufeldt. Osteology of *Eremophila alpestris*, by R. W. Shufeldt. Preliminary list of the N. A. species of Agrotis, with descriptions, by A. R. Grote. On the Nimravidæ and Canidæ of the Miocene period, by E. D. Cope. On the vertebrata of the Wind river Eocene beds of Wyoming, by E. D. Cope.

ZEITSCHRIFT FÜR WISSENSCHAFTLICHE ZOOLOGIE, FEB. 1.—On the alternations of generations of oak-gall wasps, by H. Adler. Researches on the Orthonectidæ, by E. Metschnikoff. Contribution to the knowledge of the supra-spinal cord (or ventral vessel) of the Lepidoptera, and of the central, peripheral and sympathetic nervous system of caterpillars. Especially valuable for the observations on the ventral vessel, which envelopes the abdominal portion of the abdominal nervous cord, including the last four ganglia of the imago (it does not occur in the caterpillar) of Acherontia. This vessel he found to stand in direct relation with the outer neurilemma of the ventral nervous cord, and this latter passes into the vessel. The tissue is a gelatinous connective tissue. On the pairing and reproduction of a species of Scyllium, by H. Bolau.

JENAISCHE ZEITSCHRIFT FÜR NATURWISSENSCHAFT, January 25.—The Coelom-theory, attempt at an explanation of the middle germ layer, by O. and R. Hertwig. The authors give a long discussion of the subject, regarding the Cœlenterates except the Ctenophora as possessing no genuine mesoderm, they apply the term *mesenchym* to the secretory tissues corresponding to the mesoderm of the higher animals, and then discuss the origin and relations of the mesoderm in the higher animals. Contributions to the knowledge of the structure of the butterfly's tongue, by W. Breitenbach.

THE

AMERICAN NATURALIST.

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THE ENDOCRANIUM AND MAXILLARY SUSPENSORIUM OF THE BEE.[1]

BY PROF. GEORGE MACLOSKIE, LL.D.

THE chitinous wall which covers an insect's body and lines its interior, is soft and thin for hinges and other pliable parts, and is hardened in places where rigidity is required. It is furthermore folded outwards or inwards into processes which impart additional strength or protection, or for attachment of muscles. The outgoing folds are seen in the pleura of a lobster (allied to insects) and the wing of a bee, and are always double by nature (including the outgoing and returning plates) with interposed nutritive matter, like the meat in a sandwich.

The outgoing plates (or exodemes) have their counterparts in the internal processes (or endodemes), which usually mark the boundaries between adjacent segments of the body, and which are more or less hardened in particular parts, thus forming an endoskeleton. This internal skeleton is most completely developed in the ventral part of the thorax, and where it forms the endocranium, or internal buttresses of the skull. (It may be observed that the insect has also hard processes of the pharynx and stomach which may be collectively termed its splachnodemes.)

Anatomists have not paid much attention to this class of structures, and some eminent students of insect embryology are as silent regarding the endoskeleton as if they had never heard of

[1] Paper read before the Biological Section of the American Association for the Advancement of Science, Boston, Aug., 1880.

such parts. The few references to them already published, are not distinguished by accuracy. Yet it is patent that all efforts to evolve an insect's embryology, or to give the rationale of its head, ought to include as a preliminary study the structure of its internal economy. In our present essay it is proposed to examine these parts in the honey-bee, and to compare them with their representatives in a few other insects.

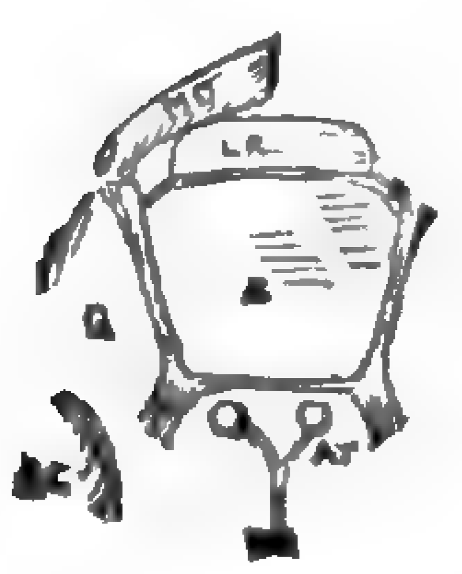


FIG. 1.—Internal view of vertex of bee's skull. EC, epicranium; AT, position of antennæ; C, clypeus; LR, labrum; MD, mandible; G, gena, or cheek; OC, ocular or compound eye.

The upper part of a bee's cranium consists of three parts, epicranium (Fig. 1, EC), clypeus (C) and labrum (LR). The epicranium is the crown, extending from the occipital foramen at back of the head, right over the vertex, to a transverse suture in front of the insertion of the antennæ (AT). It covers the entire roof and back of the head, and is medially divided in many insects (especially in larvæ) into right and left sections. It is flanked on both sides by the large compound eyes (OC), and is continuous with the cheeks which form the sides of the skull in front of the eyes (G).

A remarkable feature of the epicranial region is that it has no endodemes, no such ridges or infoldings as to hold out any suggestion of a tendency to segmentation. It has a few ridges near the occipital foramen, and a rim around the eyes and sometimes about the root of the antennæ; but we have found no trace of latent segmentation in this region. This goes against the doctrine that the antennæ represent a segment in the head; and recent discoveries in embryology indicate the same conclusion.[1]

The clypeus, or "face," is the roof of the mouth cavity. At its lateral borders it affords insertion to the mandibular condyles. (In the Doryphora, or potato-beetle, it is curiously turned in with sockets at its angles for the mandibles.) It also shows such involutions as to bring it into close relations with the endocranial system. Its posterior border (that next the epicranium) bends down into a hard transverse ridge, with thick outgrowths at the postero-lateral angles. From these outgrowths descend two pil-

[1] Balfour denies to the procephalic region any correspondence with somites of the body, and says that "the antennæ can hardly be considered to have the same morphological value as the succeeding appendages." (Comparative Embryology, Vol. I, p. 337.)

lars obliquely downward through the cranial cavity (Fig. 2, MC). These mesocephalic pillars are inserted in the floor of the skull just at the sides of the occipital foramen (FO).

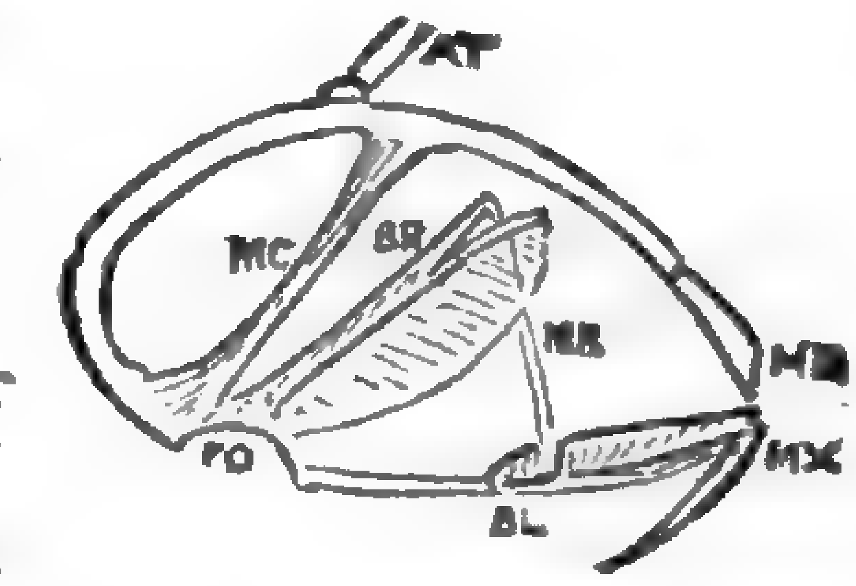


FIG. 2.—Lateral view of bee's skull. FO, occipital foramen; MC, mesocephalic pillars; AT, root of antennæ; BR, basi-suspensorium; MR, medi-suspensorium; BL, basi-labium; MX, maxilla; MD, mandible.

Thus the endocranium consists of a pair of pillars, arising by strong roots from the cranial floor, and fixed above to the clypeus. (The clypeus has to support the mandibles and to afford attachment to many muscles.) Near the top each pillar is forked transversely so as to afford more extensive support. (Fig. 3, MC.)

It is these pillars which render a bee's head so strong, though its shell is rather thin. The mesocephalic pillars of an ant's skull are similar to those of the bee; and we observed short tendons in the neck serving to antagonize them.

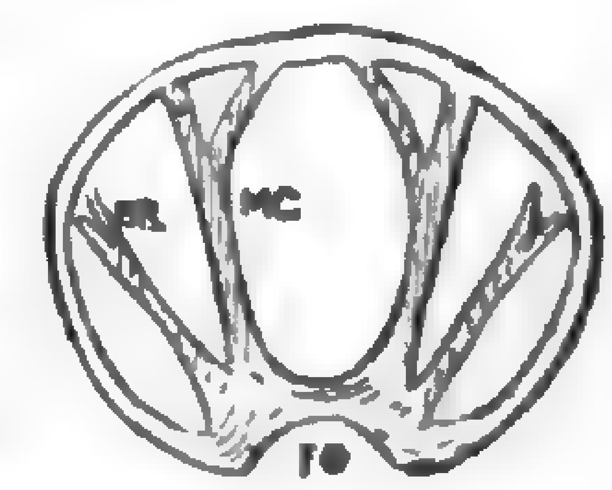


FIG. 3.— Diagrammatic view of bee's skull in transverse section. References as in Fig. 2.

The pillars ascend in front of the cerebral brain-lobes, running between them and the ophthalmic lobes, and keep the large ocular apparatus in its proper place.

Burmeister's well-known account of the endocranium of insects has many errors. He represents that of Hymenoptera as rising from the base and ending in two points; he seems to have broken off the pillars and so missed their attachment to the clypeus. He says that Diptera and Hemiptera have no endocranium. This is partially true of the Muscidæ; but we have shown[1] that in all probability the basal part of the proboscis of these insects represents the endocranium, and there is a rudiment of the endocranial roots in a small bridge across the occipital foramen. In the large gadfly (*Tabanus atratus*), and in the mosquito, we find cephalic pillars as in the bee (besides what seems to be a splachnodeme or pharynx-case supporting the complex oral armature.) *Coreus*, of Hemiptera, though seemingly devoid of mandibles, maxillæ, labium and all processes related to them, has a pair of processes depending from the clypeus, in the position of the upper part of the mesocephalic pillars. These probably support the pharynx and the roots of the long piercing bristles.

[1] See AMERICAN NATURALIST, March, 1880. "On the Proboscis of the House-fly."

Burmeister attributes to Lepidoptera nothing more than a small bar across the occipital foramen. But we find (in the swallow tail, *Papilio turnus)* a strong sub-quadrate frame arising in front of this foramen, and reaching forward so as to be fixed near the roots of the proboscis.

That the mesocranial pillars represent involutions of the outer walls, may be understood from the trunk of the cray-fish, where (as Mr. Huxley has well shown) the ingrowths become plates or ridges, or even pillars. But we find a closer illustration in the heads of some other insects. Cicada has similar pillars with the bee, somewhat flattened out and attached to the sides of the head (the eyes here not reaching so far forward). This would indicate that in the bee the ridges have been displaced inwards by the encroaching of the eyes. (The clypeus of Cicada is transversely barred so as to show about ten pseudo-somites. It is easy to examine these parts from one of its exuviated shells.)

The dragon-fly has a stout ridge below the occipital foramen, sending up processes to the clypeal region, as in the bee. But these processes are broadened out and transparent, and not rigid. The clypeus itself is soft and swollen, and has a deep transverse ridge to meet the processes. Thus the large, weak cranial wall is somewhat but slightly strengthened.

The attempt to correlate the parts of the bee's head with those of the head of the cockroach, gave rise to some interesting revelations. Here Huxley's excellent description of the cockroach ("Anatomy of the Invertebrated Animals") was in good season, but we soon found that his work was superficial and faulty on this part. He states that the endocranium of the cockroach "extends as a cruciform partition from the inner face of the lateral walls of the cranium to the sides of the occipital foramen;" and speaks of the center of the cross as being "pierced by a rounded aperture through which the œsophageal nerve-collars pass." In fact, it is not cruciate in form, but consists of two pillars as in the bee (only softer), and united by membrane some way up, *i. e.*, crotch-webbed like the webbed fingers of a water-fowl. The upper band running across is a fascia binding the two mandibles together (present in the bee, though not thus united with the mesocephalic rods). Thus we have a "tentorium," or mesocephalic plate, forming a thin diaphragm across the middle of the cranial cavity, with thickened borders in front and laterally, and itself concave upwards so as to form a channel for the pharynx (Fig. 6, EC). Its perforation is not as in the axis of a cross, but forwards, as if the webbing had ceased at this part. Its correspondence with the parts already described in other insects is easily shown. In the locust the lateral pillars approach more closely, so as to resemble the letter X, but the foramen and other parts are much as in the cockroach.

The Coleoptera appear to want this system. But in following out the relations of the parts I came to a view which, if correct, would explain the anomaly, and which I shall reserve for a later part of this paper.

B. Maxillary suspensorium.—It is convenient to examine together the proximal adjustments of both maxillæ and labium (or first and second maxillæ, as they may be called). These are intimately connected in their mode of attachment in all insects possessed of such parts. In the case of the bee they are strung upon a long framework with elbows and hinges, which is able to thrust them out and to draw them in. Of this framework, which we shall call the "maxillary suspensorium," we have not been able to find any satisfactory description or figure. Schmarda's Zoölogy gives a correct figure of its distal part; but neither Schmarda nor Westwood nor Réaumur appears to have traced the structure to its origin. The prize work on the "Anatomy and Physiology of the Bee," by M. Girdwoyn, published by Rothschild, of Paris, is grossly inaccurate at this part. We shall begin its description from its base, where it is inserted close to the inferior insertion of the mesocephalic pillars, immediately in front of the foramen magnum.

At this point there are, below the mesocephalic pillars, two basi-cranial rods, running forwards towards the oral opening (slightly ascending forwards when the mouth parts are retracted, but nearly horizontal when they are protruded). These basi-cranial rods arise similarly with the mesocephalic pillars; but they are united to the sides of an excavated opening in the basis cranii by a thin web, just as the mesocephalic pillars are joined to the side-wall in Cicada. They are not hinged at their root, but are firmly fixed and widen out here, and are slightly pliant, whilst their motion is limited by the web which binds them to the basi-cranial wall (Fig. 5, BR). (An engineering friend to whom we showed this structure, informed us that it involves the principle of a machine recently patented for producing a slight and steady motion combined with strength.) The two parallel basi-cranial rods are also connected with each other by a very thin and pliable sheet of chitine, which forms the lower bounding wall of the head at the excavated part, and yet allows perfect freedom of motion to the suspensorial mechanism.

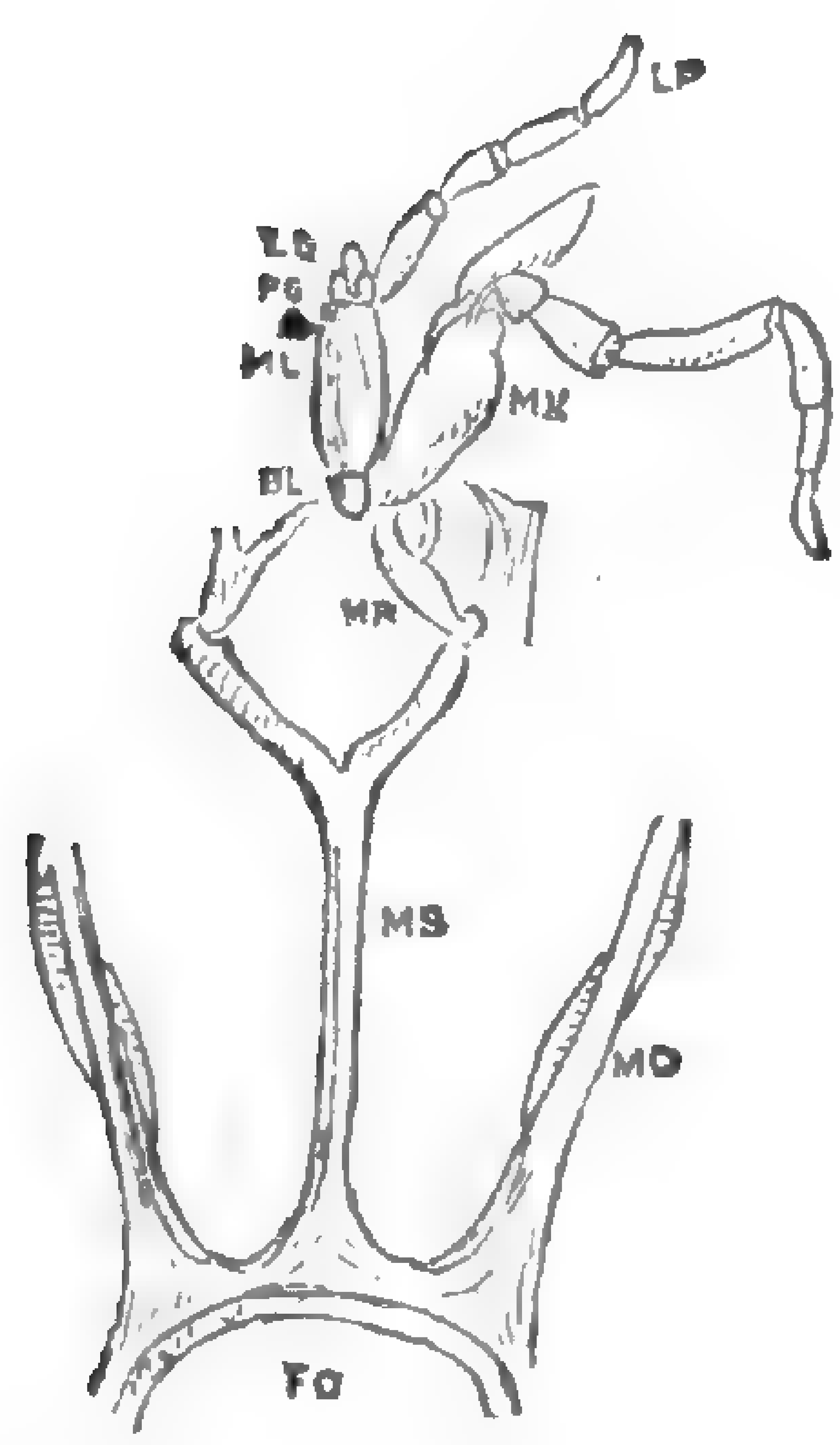
The basi-cranial rods are forked at their distal ends, where they support the *maxillary rami*, one at each side (Fig. 5, MR), which are joined to them by a very perfect elbow-joint, enabling the rami to fold downwards. The rami support the maxillæ, which can thus be protruded or withdrawn. We think that each of these rami corresponds with the cardo or basal segment of the maxillæ of the cockroach or beetle (though this name has been given to the process next to be described).[1]

The *modus operandi* of the maxillæ on these rami is noteworthy. Each maxilla consists of a flat base (stipe), surmounted by a lacinia resembling a knife blade, and bearing a rudimentary palp at the middle; and its lacinia can bend downwards and backwards so as to be out of the way and to present the stipe as a flat projecting plate. When the mouth parts are retracted, the two maxillæ are thus bent down, and their plate-like stipes are approximated, so as to form a hard under lip for the mouth, upon which the mandibles play in their operations (as on a piece of cork, or in cell-making as when the carpenter-bee is operating on wood). The basi and medi-labium then fill the excavated part of the basi-cranial surface. When the suspensorium is being protruded, the thin membrane which borders its proximal joints and which is extended so as to reach the blades of the maxillæ, becomes tense and divaricates them so as to secure their steadiness of motion and to give free play to the intervening labium.

From the distal end of the maxillary rami proceed two *labial rami* to support the labium, thus giving an additional joint, with a hinge which moves freely backward and forward. (This is the piece usually called cardo; we shall call it *labial ramus* of the suspensorium, or labi-suspensorium.) By means of it a very

[1] Dr. Hagen has shown us Wolff's article on "Das Riechorgan der Biene" in *Nova Acta Leop. Carol.*, Band XXXVIII (1875), with beautiful and accurate drawings of the structure of the bee's head. The author does not appear to have studied the parts in the relations here discussed; and he is altogether fanciful in identifying the hard parts and the muscles of the bee's skull with the bones and muscles of the mammalian head.

great degree of motion backwards and forwards is allowed to the labium, which mobility is still further increased by the protrusibility of its ligule or distal piece. The labium consists of a basal piece, usually termed submentum (we would rather call it basilabium, Fig. 5, BL); of a medial piece, usually termed mentum



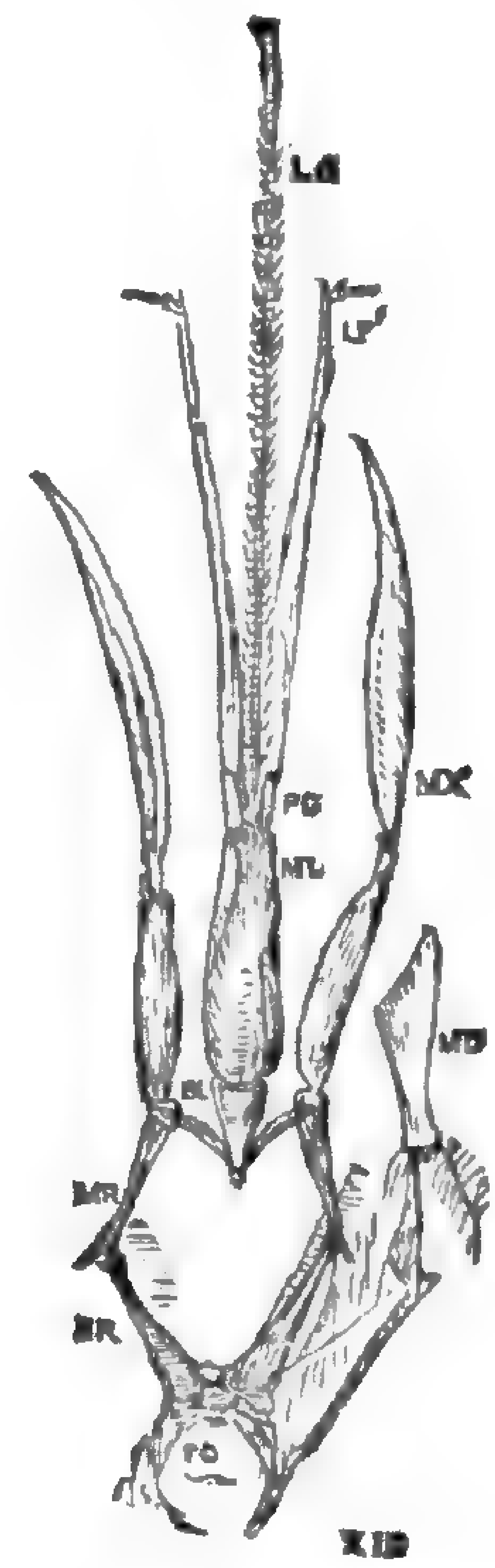


FIG. 4.—Suspensorium and mouth parts of ant. MS, basi-suspensorium; MC, mesocephalic pillar. The other references are as in Fig. 5.

FIG. 5.—Suspensorium and mouth parts of bee. FO, occipital foramen; BR, basi-suspensorium; MR, medi-suspensorium; *below* BL, labi-suspensorium; *to left of* BL, basi-labium; ML, medi-labium; PG, paraglossæ; LP, labial palp; LG, ligule or outer tongue; MD, mandible; MX, maxilla: the terminal part of the maxilla is the lacinia, the basal part is the stipe, its narrow middle part has a rudimentary maxillary palp. One of the endocranial pillars is seen extending from beside the occipital foramen to near the insertion of the mandible.

(we would call it medi-labium, ML), and of what we may call a disti-labium, consisting of paraglossæ (PG), of well-developed labial palps (LP), and of the terminal ligule (LG), about which a great deal has been written.

In such bee-like insects as do not protrude their maxillæ, these parts are more or less simplified, so as often to illustrate and explain the complex arrangement of the bee. Very often the distal parts of the labium are reduced or condensed (so as to resemble somewhat the swollen tip of a housefly's proboscis). In *Stizus grandis*, with non-retractile proboscis, we found the basicranial rods to be merely a high ledge running forwards around the excavated part of the basi-cranium, and serving for insertion of the maxillæ. This shows clearly how the excavation and the rods and connecting sheets arise by an involution of the cranial wall, with thickenings in special tracts.

The large black ant *(Formica pennsylvanica)* carries our thoughts still further. It has only one basi-cranial rod (Fig. 4, MS), extending forward above the basi-cranial wall (which is not excavated). This is derivable from the case of the bee, on the supposition that the basal rods and the margins of the basi-cranial involution have approximated medially so as to coalesce. The ant's suspensorium has a medi-suspensorial pair of maxillary rami (MR), as in the bee; but its labial rami are so small as to be nearly obsolete. Its basi-labium (BL) and its medi-labial case (ML) are much as in the bee; but its disti-labial parts are condensed.

The series of gradations thus attained holds out inducements to pursue the subject, and we may perhaps see the beginning of a new line of discovery in this field. Compare, for example, the maxillary adjustments of the cockroach with those of the insects already described. Here again Mr. Huxley is less happy than usual in his anatomical descriptions. He states that the basal piece or cardo of the maxilla of the cockroach is connected with a thin band which runs round the posterior margin of the epicranium and is firmly united with it only on its dorsal side. He does not indeed represent the maxillæ as directly inserted in the back of the skull, but he regards them as attached to a band which is itself attached to the back or dorsal aspect of the skull, and which he is thus compelled to consider a portion of its exoskeleton. This view, if sustained, would clash with the mode of suspension in the bee, where the maxillæ have been found to have endocranial connections with the base or ventral side of the skull.

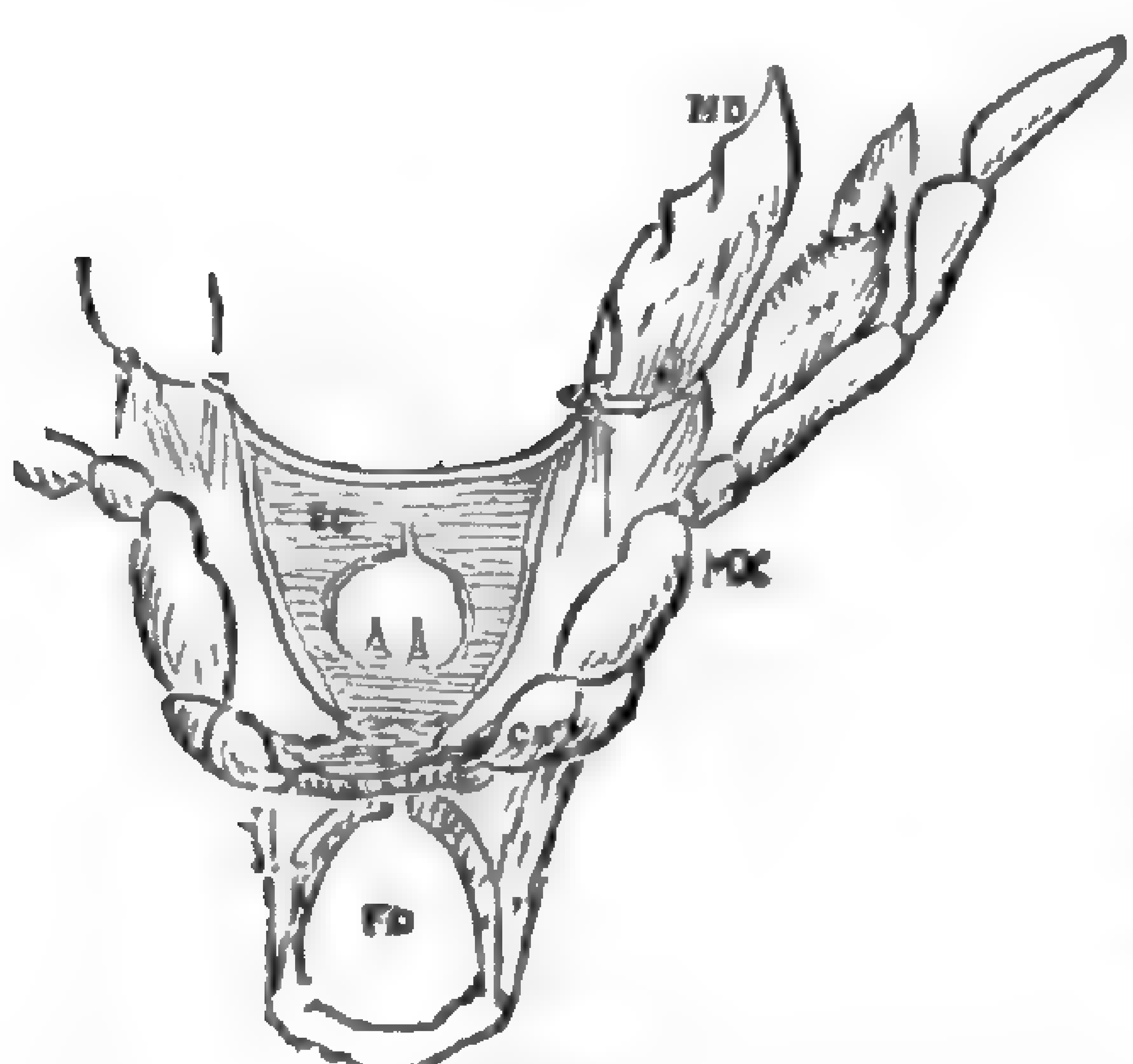


FIG. 6.—Endocranium and maxillary suspensorium of European cockroach (*Periplaneta orientalis*). EC, endocranium; CA, cardo. Other references as in Fig. 5.

A careful examination of the connections in the cockroach, proves, however, that the cardines of the maxillæ are inserted in a ridge which crosses the basis-cranium in front of the occipital foramen (though a slender ridge runs from this part round the occipital foramen, as usually occurs in insects). This transverse ridge is intimately connected with the roots of the mesocephalic system; and may be deemed a condensed variation of the bee's suspensorium.

The Coleoptera have presented the greatest difficulty here, a difficulty which has been long felt by zoölogists. With the Coleoptera the basi-cranial region is so unlike that of other insects that a special nomenclature has been devised for it; and the terms *mentum*, *submentum* and *gula* are properly confined to the beetles (the application of these terms to other insects has been, in some measure, guess-work). The base of the head failing us as a guide, we started from the other end, or front. Here it was easy to find in the clypeus of Lachnosterna the points from which the mesocephalic pillars ought to descend; and there the pillars actually are, but they appear as involutions of the wall, and they descend not to the vicinity of the occipital foramen, but further forward to the region of the submentum, and near them the maxillary cardines are inserted. The interpretation of these observations is easy. Mr. Huxley has sought the representatives of the beetle's basi-cranial pieces in the neck of the cockroach; the facts now given appear to say that in other insects (as the bee) they are condensed into the very complex and strong system of ridges which borders the front of the occipital opening. The Coleoptera alone have these parts resolved so as to show the primitive arrangement. The fact that they reach the basi-cranium at the point of insertion of the maxillæ, is in complete harmony with what we have seen in the bee. We observed in the basi-occipital region of the head of Lachnosterna, and still more distinctly in the stag-beetle, an overarching frame, enclosing a nervous canal similar to the sternal canal of the thorax. We may, perhaps, detect traces of this in the very intricate cross-bars in advance of the forámen magnum of the bee; so that here the sternal canal and the roots of the mesocephalic and basi-cranial processes are all crowded together. (Thus it is not correct to say that Coleoptera have no endocranium, although Gegenbaur makes a slip when he cites them as an example of largely developed endocranium.)

Only a few words can be added as to the cranial splachnodemes, or that part of the endocranium which consists of hardening of the pharynx. The mouth is floored by a stiff tongue-like plate (we may call it *lingua*, not to be confounded with the ligule already mentioned). The tip of this lingua is deflected downwards, and from its base run backwards two long barbed processes. Over the mouth is a similar but simpler structure, called epipharynx, and to these the borders of the pharynx are attached, and also muscles. If we force open the mouth (by pulling down the maxillæ), we find the open mouth overarched by epipharynx (connected with the labrum), floored inwardly by the lingua (or inner tongue, formed by the floor of the pharynx), enclosed at the sides by the long tendons of the lingua which are stretched up like faucial door posts. All these hard parts keep open the soft membrane of the pharynx, just as the iron frame of a dredge keeps open the netting attached to it. In the upper part of the cranial cavity are racemose glands which send down a pair of ducts to the inner tongue. The great salivary apparatus of the thorax sends forward its ducts which unite and penetrate through the basi and medi-labium to the ligule or long outer-tongue.[1]

It would be premature, at the present stage of our knowledge, to theorize upon these facts. They indicate a fundamental unity of structure of the heads of all insects; but how far and in what directions it is varied, and what is its relation to other parts of the body, are questions needing further research.

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MYA ARENARIA IN SAN FRANCISCO BAY.

BY ROBERT E. C. STEARNS.

IN November, 1874, Dr. W. Newcomb, who at that time resided in California, described in the Proceedings of the California Academy of Sciences, a species of Mya which had been given to him by the well-known collector, Henry Hemphill, who detected several specimens of the form on the shore of Alameda county, on the eastern side of San Francisco bay.

The specimens were about two-thirds of the usual average size

[1] Siebold discovered a triple salivary system in the bee; but the text books are still sadly at variance with each other and with the facts, in their treatment of this part of the subject. Some place the bee's salivary glands in the head, some in the thorax, and some say they are sometimes in one part and sometimes in the other!

of *Mya arenaria*,[1] rather fragile in substance and delicate in sculpture.

As Dr. Newcomb considered it a new species, he described it as above and gave it the name of *M. hemphillii*, remarking that "the only species with which it can be confounded is the *Mya præcisa* of Gould, which Dr. Carpenter considers as identical with *M. truncata* of the North Atlantic. A specimen of *M. arenaria*, from Puget sound, in my collection, is quite distinct from this species, and, like many of the circumpolar species, is common to the North Pacific and North Atlantic. It is quite distinct from the fossil *M. montereyi* Conrad, as I am informed by Dr. Cooper, who kindly made for me the comparison of this shell with Conrad's figure and description."

Since 1874, the date of the description, the Mya has become abundant, and is found for miles alongside the easterly shore of the bay, and is now the leading clam in the markets of San Francisco and Oakland, superseding to a great extent the previous "clams," *Macerna nasuta* and *Tapes* (or more properly *Cuneus) staminea* Conrad, in its varieties, especially *diversa* Sby., and the now dominant clam of the fish-stalls, is found exhibiting all of the characteristics of *Mya arenaria*, and is universally conceded to be the same as the Atlantic species.

My friend, Dr. Newcomb, as quoted above, it will be seen, regarded his Puget sound Mya as *M. arenaria;* which is the region from which Gould's form, *Mya præcisa*, was brought, and if related to another form, is more likely to be a variety of the circumpolar *truncata* than to be *arenaria*.

None of the more recent and reliable collectors referred to in Carpenter's Supplementary Report (1863) to the British Association, neither any collector since this date, to my knowledge, has verified the occurrence of *M. arenaria* at any point north of San Francisco bay on the west coast of America. Gould was certainly familiar with a form so common on the New England coast; and though perhaps in this day and generation we hold rather broader views as to what constitutes a species than some of the old mas-

[1] The only bivalve along the coast or in the bay of San Francisco which might be mistaken for or identified with *Mya arenaria* is *Schizothærus nuttalli* Conrad, which when mature is two or three times as large as the largest specimens of Mya. Dwarfed forms of the large species are found at low tide on the flats connected with Goat island on the east. In this species the siphons are enclosed in an external sheath, the same as in Mya, making what the unsophisticated call a "long neck."

ters, yet he certainly would have noticed it, had the shells before him been closely like the more common Linnean species.

Middendorff credits it to Sitka,[1] etc., but this is not supported by any of the numerous subsequent authorities.

As to its presence on the Asiatic side of the North Pacific, Middendorff credits it to "Kamchatka" and the "Ochotsk sea." Jay, in (Vol. II) Perry's Japan Expedition, describes it even as "*M. japonica*," and credits it to "Volcano bay, Island of Yeddo," remarking that it "is very similar to *M. arenaria*." Arthur Adams,[2] who collected in Japan, pronounced it identical. It has also been detected in Hakodadi bay, and Professor Morse says "the typical northern form *(M. arenaria)* lives in the Gulf of Yeddo to-day, and its shells are found in the mounds of Omori."[3]

It must be admitted that the species is found in these Asiatic stations upon the testimony here adduced, but as to its presence on the coast of Western America at any point north of or anywhere outside of San Francisco bay, the fact that neither Nuttall, Jewett, Kennerly, Lord, Swan, Cooper, Harford, Dunn, Hemphill, Hepburn, Fischer, Dall, Newcomb (in the field), and many others, as well as myself, have never detected a specimen prior to the date of my friend Newcomb's description (or since, so far as I can learn), ought to be sufficient evidence on this point.

From whence, then, came the seed which has produced the abundance of this species which has spread and is now spreading rapidly along the shores of San Francisco bay?

Examine the ancient shell heaps and mounds found hereabout, and one may find the thin broken valves of the Macomas, but not a fragment of the shell of Mya. One may find the shells of the native Haliotis and Olivella and the beads and money or ornaments made from them; the bones of the common California deer, of the whales, and perhaps other animals, all of which are still to be found in the neighborhood or not many miles away, but not a piece of Mya. The ancient clam-diggers, whose kitchen-middens are met with in many places on the Alameda and other shores of the bay, whose skeletons and implements are sometimes exhumed or discovered, had "passed over to the majority" centuries before the advent of *Mya arenaria* in California waters. To proceed to the question—was the seed of this mollusk intro-

[1] B. A. Report, 1856, p. 219.

[2] Id. Rep., 1863, p. 588.

[3] Amer. Naturalist, Sept., 1880, p. 657–8.

duced from the waters of the Asiatic shores of the North Pacific or from the American shores of the North Atlantic? If artificially introduced, of which there can be no doubt—from which direction does the extent and character of the traffic of our commercial intercourse make it most probable that the species came or was brought? By water on the steamships from Japan, or by railroad three thousand miles overland from the Atlantic seaboard?

With the completion and operation of the trans-continental railroad, our oyster men, many of whom have a large capital invested in the business, commenced the importation of small oysters *(O. virginica)* from the Atlantic side, by the car load, for planting in San Francisco bay, where in a season or so they attain a merchantable size, growing exceedingly fat; as yet, efforts to propagate them have not been successful; but the importation still continues as before, the profit to the oyster planter being simply through increase in size and not from multiplication of numbers by propagation.

There is no similar traffic with Japan, and it is hardly possible that the fry of *Mya arenaria*, if it did adhere to the bottom of the steamers in Japanese parts would be able to hold on for so long a time or for so great a distance with the friction of the water against the bottom of the steamer constantly operating to sweep it off.

Native oysters are also imported from various points in Washington Territory, and planted in the bay, but we have no knowledge of the Mya existing at any point in the region from whence these latter oysters are brought.

In the presence of the fact of the rapid increase of this truly excellent edible, next to the oyster the most valuable either as human food or fish bait, of any of this class of food, and the inference from its spreading so readily in San Francisco bay, that other places along the coast might prove equally congenial to it, it would be a wise, public spirited act if the captains of our coasting vessels would take the trouble and incur the slight expense attending the planting of this clam at such points as their vessels touch at in the ordinary course of business.

Since the manuscript of the foregoing matter was sent to the Naturalist, I have received specimens of *Mya arenaria* from my friend, Dr. C. L. Anderson, of Santa Cruz, for identification. Santa Cruz is on the coast at the northerly end of Monterey bay, about seventy-two miles south of the entrance to San Francisco bay. The specimens are rather under, than of, the usual size, and were obtained at the mouth of a lagoon near Santa Cruz.

In a few years we may look for its distribution southerly and along and around Monterey bay, the shores of which are well adapted for this species. As to its introduction at Santa Cruz, I hope to be able to give more particular information hereafter.

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THE SQUID OF THE NEWFOUNDLAND BANKS IN ITS RELATION TO THE AMERICAN GRAND BANK COD FISHERIES.

BY H. L. OSBORN.

THE broad continental plateau which fringes our eastern coast, rises in many places near to the ocean's surface, and forms shallows known in sailor language as "banks." These banks have, on the average, a depth of thirty fathoms, though in some places but seven or eight fathoms, and are a favorite resort of the several species of our most important food fishes, visiting the places to prey upon the many forms of marine invertebrates covering these favoring spots in most luxuriant profusion. In most cases the banks are not extensive, not more than from ten to twenty miles in length, but this rule finds a notable exception in the case of the Grand Bank, off Newfoundland. This shoal is in shape nearly an equilateral triangle; its base is two hundred and seventy miles long, running east, north-east, and lying somewhat east of south-east from the island. This northern edge, furthermore, is sixty miles distant from land, and the intervening water has an average depth of eighty-five fathoms. The edge of this shoal is very clearly defined, the water along the northern limit falling suddenly, in the distance of only a mile or two, from thirty to sixty fathoms, while, on the other sides, the descent is frequently very rapid from thirty to one hundred and eighty fathoms. It has been noted as the most favorable grounds for the capture of the cod since before 1740, at which time seventy vessels from Gloucester alone, scoured the banks, and since which time the number has fluctuated, till at present more than four hundred schooners are engaged in the pursuit. The problem of bait has always been a troubling one to this enormous fleet. I am told that in early days salt bait of clams or fish was in universal use, but of late some sort of fresh bait has seemed a necessity, and the squid has become the favorite form. This they are forced to procure at Newfoundland, and they have thus opened a new traffic to the people of the island, and caused, too, at times, much hostility and ill-feeling.

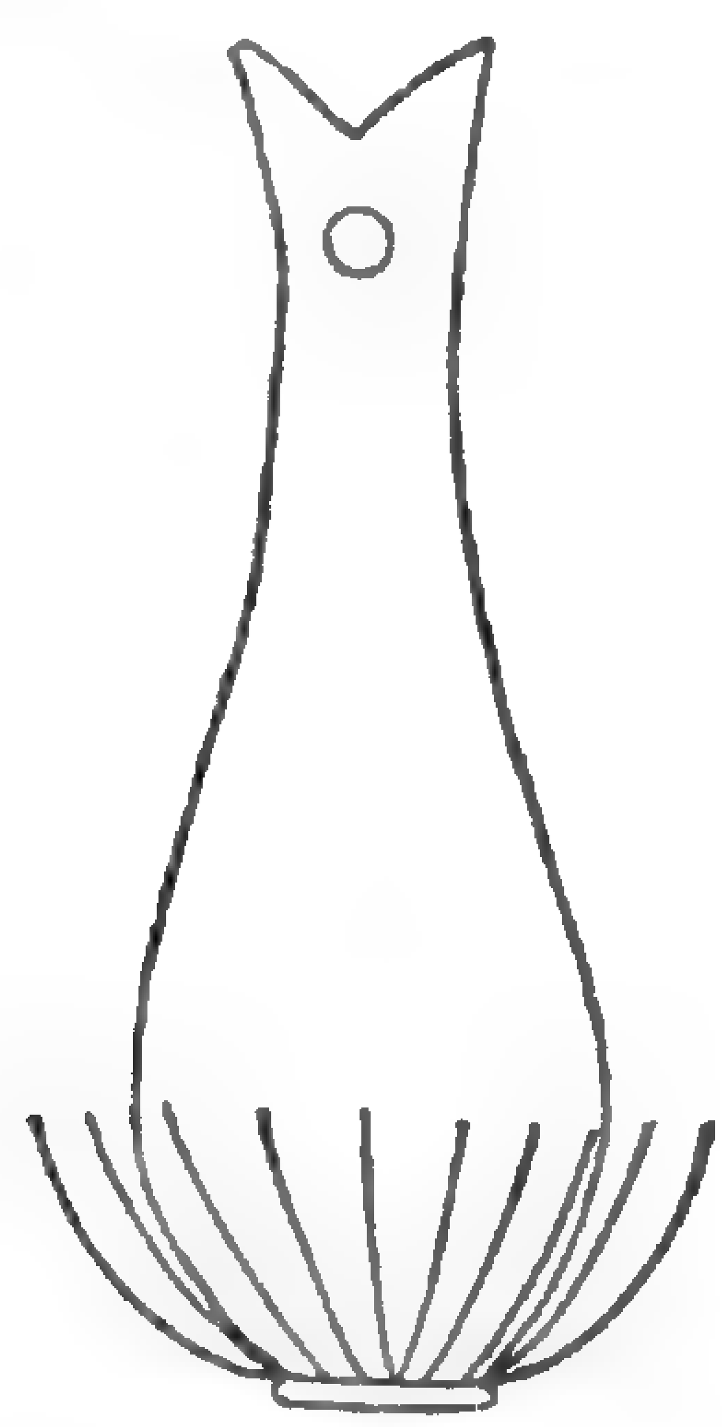
During the summer and fall of 1879, I had the opportunity of spending three months on a codfishing schooner, for the purpose of making zoölogical collections, and also of studying the men and their methods; this gave me a chance to visit a large number of harbors, and to study in some detail the matter of bait.

The bait used during the latter part of the year is the squid; not *Loligo pealii* Les., the common form of the ocean waters south of Cape Cod, but *Ommastrephes illecebrosa* Quatr., a more northern species readily distinguished by its movable eyelids. So many good descriptions and figures of this species are in the reach of every one, that any description of the creature is unnecessary in this place. For accurate description of the wonderful changes of color in the integument, I would refer the reader to Professor Verrill's account[1].

The squid does not appear early in the year, during which time the herring, *Clupea harengus*, and the capelin, *Mallotus villosus*, are used, but "strikes" late in June or early in July, touching first upon the southern points of the island. The natives and the fishermen agree in the opinion that the squid migrates steadily northward during the season, appearing first in the northern harbors two weeks later than in the southern, and finally lingering at northern points in the island after they have entirely disappeared from those further south. One is induced, moreover, to believe in a migration among the squid, from the intermittent manner in which they are captured. At one time they are taken as fast as they can be hauled in, while, again, scarcely any can be caught. Furthermore, captures of different times will often average very differently in size, indicating that those of the same ages move in the same schools, and that one school is replaced by another. Thus on one day we secured a large number of very large squid, the largest measuring 290 mm. and the average 265 mm. from base of tentacles to tip of tail, but on the following day could obtain none whose length was greater than 190 mm.

[1] Invertebrates Vineyard Sound, pp. 442–443, 1874.

Evidence is not wanting to show that the squid do sometimes occur on the Grand Banks. Vessels are reported to have caught their bait while at anchor there, and yet I can but regard this as the exception, and I believe that the habit of the squid is to remain during the summer quite near shore. In examination of the stomach contents of the cod, I saw nothing to indicate the squid's presence on the banks. This to be sure is negative evidence, yet it carries some weight.



Squid jig.

The sole mode of capture of the squid is called "jigging," a term derived from, and descriptive of the process. The only gear is a peculiar hook called a "jig," and a couple of fathoms of "mackerel" line. No bait is employed. The jig is of lead, two inches or thereabouts in length, armed at its base with sharply pointed unbarbed pins radially arranged, and curving upward and outward as represented in the accompanying figure. The jigging is conducted in water of from eight to ten feet, usually from small boats, but occasionally from the vessel's side. The jig is allowed to sink nearly to the bottom, where it is kept constantly vibrating up and down, till the squid is felt upon it. Frequently two jigs are managed, one in each hand.

In its mode of taking the hook, the squid differs from any other animal I have ever met. In place of a nibble followed by a snap with the subsequent struggle for escape, there is a sensation as of some one grasping the hook with his fingers. The squid does not use his mouth in "biting," but merely clasps his tentacles round the jig. The pain from the sharp pins doubtless induces him to escape instantly, but the fisherman who is constantly jerking the jig up and down, pulls in as rapidly as possible, entangling the squid's arms among the pins, and drawing him through the water so fast that escape is impossible.

The instant he emerges from the water he contracts his body, discharging through his siphon a jet of salt water. This is followed by a sucking in of the air by successive respiratory acts, till in its middle portion his cylindrical body has become almost spherical. By a second contraction, the squid now ejects from his siphon a stream of his black, inky secretion. He will usually make one or two or more contractions in an effort to escape, after which he becomes resigned. Not infrequently it happens that the luckless wight has not the squid unhooked before the inky discharge, and may have this sent at himself, since the siphon points away from the animal and upward. I have often seen a fellow struck full in the face by the inky stream, which event was invariably followed by a stream of almost as black abuse intended for the benefit of the squid.

The squid is unhooked by simply turning the jig upper end downward, when he readily drops off. For the most part they are caught wholly by the natives, the Americans usually preferring to look on or to find amusement ashore, though in some cases the fishermen themselves jig also. This, however, is apt to excite jealousy among the natives, or even such hostile feelings at times as to induce them to forcibly prevent the Gloucester men from catching their own bait, or even to purchase it in their harbor. The scene when the squid are thick is really exciting, the streams rising here and there, in twenty directions at once, point out the rapidity of the catch, and the monotonous noise of the squirt is only varied by an occasional murmur of discontent from this or that unfortunate as he lifts his querulous voice. In the dull time most of the jiggers drop away, leaving only those most long-suffering ones, but they return pell-mell if the frequent squirt shall indicate renewed activity.

The purchase of the squid is made at a certain price per hundred, this being usually thirty-five or forty cents, though occasionally falling as low as twenty-five cents. The price but rarely rises above forty cents, for the profits are too small to permit of its reaching a much higher figure. The number used by a single vessel in only two months is astounding. Our vessel, a small one, made three "baitings," fishing each time about two weeks, and used in that time 80,000 of the squid. A larger vessel, carrying two more men, would in the same time have probably used over 100,000. As to the whole number of squid used in a single season by Americans alone, I have not sufficient statistics to give an accurate statement, it would, however, be reckoned high in the tens of millions.

In delivering his squid, the native accurately counts them, taking up five at a time and throwing out one at every hundredth for tally. And in this the native stupidity appears, for had he ten thousand to dispose of, he would handle over the entire number rather than estimate their value by weighing or measuring. Since they must be each paid separately, and never have themselves any change, the skipper is forced to carry with him a large supply of fractional pieces, so that he will not unfrequently have one or two hundred dollars on board in five, ten and twenty cent pieces of Newfoundland currency, having secured them at some of the larger towns by a draft on his vessel.

It is very strange that, though such an enormous and often pressing demand for the squid exists, no enterprise has ever been undertaken for facilitating its supply with the least possible delay. A vessel is by no means infrequently delayed two or three weeks, and in the course of her search forced to visit harbor after harbor till she had coasted along-shore three or four hundred miles. To such an extent is this true, that the vessel will often spend more time in the search for bait than it afterward takes to use it up. This trouble might be obviated with the greatest ease, for, in time of plenty, the squid might be preserved in ice to be drawn upon when, in a lull, the catch was not large enough to supply the incoming vessel, and the vessel could then return to her fishing ground with the loss of but a single day. Nor would there be any difficulty in procuring ice in Newfoundland during the winter, nor any danger that the bait could not find a market, for the fishermen would not be long in advertising such a place both far and wide. Even if there were some means of communication between the harbors the trouble would be far less than at present; it would be utterly impossible to drive a horse in most directions, and there is scarcely a telegraph line in the island. Hence when the fisherman seeks bait he must cruise about till he finds it, and at present he spends twice as much time in sailing and bait-hunting as in the actual work of fishing.

When at night the day's catch is brought on board, the men proceed to preserve the squid either by salting them or by placing them in ice. In case the season is growing late the skipper has several thousand well salted and stowed for use when fresh squid can no longer be had. But most of the squid are sandwiched in layers of two or three deep between layers of finely broken ice in bait bins in the vessel's hold. Twenty-five or thirty thousand are thus cared for at a "baiting" and will keep in fit condition for use from two to three weeks. In using them each squid is cut into about five pieces and one piece is used for each hook. The hooks are usually well cleaned by the carnivorous gastropoda which infest the banks and by the various fish which are not caught, so that the same piece of squid is rarely used on two occasions. The fish do not bite with the same avidity at the last of the baiting, the fresh bait securing by far the most fish. The salt squid is nearly useless in the summer and early fall, but late in October, I am told, that they are used with considerable success.

In what I have said, I have made no mention of any use of the squid save by the Americans, but I cannot leave the subject without a brief mention of other uses fully as important as this. The Newfoundlanders themselves use an enormous number, both for bait in their shore fisheries, and as a fertilizer for their land. I have been assured, also, that they are good to eat, but though food materials are not abundant on the island, they are not put to this use there so far as I know. The French, moreover, have very extensive fisheries on the Newfoundland coast fully as important as the American, I should judge, their vast size being insured by a bounty offered by the government to fishermen, and by the practice of reinforcing the numbers from among the national convicts. These French vessels do not seek their own bait as is the case among Americans, but are supplied by vessels, which make a specialty of collecting bait, and spend their time alternately in its search, and in its delivery. To a very large extent, I understand, the French use salt bait, they being content with small catches, while the American is disgusted unless he makes fine hauls every day.

And having thus seen the present importance of this industry, does it not seem strange that it has existed but ten or fifteen years, and that, previously for one hundred and fifty years, innumerable fish were captured with salt bait, or the viscera from the catch of the day before? This fact illustrates a most striking characteristic of the American fisherman—the strong conviction that the fish have decided preferences in the matter of bait and will not take any kind which is out of season. He will often spend the entire month of August in fruitless search rather than use herring or capelin and gain but a moderate success; nor could any argument convince him that a codfish would bite at a salt clam while "the fleet was using squid."

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THE BRAIN OF THE EMBRYO AND YOUNG LOCUST.[1]

BY A. S. PACKARD, JR.

[*Continued from April number.*]

Structure of the Brain in the Embryo Locust.—Much light may be thrown upon the structure of different parts of the adult brain if we can trace their origin in the embryo, or in the larval and pupal conditions. Hence, we have, with what material we could obtain, made a series of sections of the embryo and different stages of the larva and pupa, with some results of considerable interest and importance. No one, we belive, has yet examined the topography of the brain of the embryo insect. The only observer who has studied the brain of the larva, as compared with the adult, has been Flögel. Speaking of the cockroach, he says:

"Of special interest would be an investigation of the development of the separate parts of the brain. The difficulty of making preparations of small heads has been such that no particular results have been reached. Still, I can say this much, that in small creatures, 7–8 mm. in length, all the parts are present, only of a finer and more delicate structure than in the large adult 25 mm. in length."

He says that in the Hymenoptera he has discovered much concerning the development of the parts of the brain; that in bee larvæ the calices are present, though very small and with thin walls. The peduncle and trabecula have reached their ultimate proportions more nearly than the cauliculus, which is still very thin. In the larval ants the central body and entire mushroom

[1] Adapted from the 2d Report of the U. S. Entomological Commission, Washington, 1880.

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THE BRAIN OF THE LOCUST.

bodies are present, though an early larval stage shows, in place of the calices, four symmetrically situated balls of much smaller size; the central body was very flat, and the other parts were wanting. In the pupa all the parts had attained their definite shape. It appears from his observations that the calices are the last to be developed.

He then gives the results of his examination of the brain of caterpillars, as compared with that of the adult sphinx moth. In a caterpillar examined near the time of pupation, the central body is very much undeveloped, forming a small linear transverse body (Querleiste), while the different parts of the mushroom body are indicated. In smaller caterpillars it is scarcely possible to work out the development of the brain. In that of *Pontia brassicæ* the mushroom body and central body were undeveloped, while in that of an Euprepia larva the double stalk of the mushroom body was developed, as well as roundish calyx masses. But in a Noctuid larva the entire mushroom body, including well-developed trabeculæ and a very flat central body, was present.

The brain of the mature pupæ of Lepidoptera, for example *Saturnia carpini*, contains all the portions of the adult brain, and in the same relative proportions. But a brain of *Sphinx ligustri*, in a considerably younger stage of development, did not differ much from the brain of the larva.

We offer the following observations on the brain of the embryo locust, shortly before hatching, with much diffidence, as we are liable to be corrected by future observations in the same directions. The embryos were taken from the egg-shell, hardened in the usual manner, and then cut by Mr. Mason, the sections being frontal, the entire insect being embedded in a mixture of paraffine, wax and oil.

In the youngest stage (which we will call stage A) observed, the body and appendages were formed and the eyes with their facets, the pigment mass coloring the cornea pale reddish.[1]

At this stage, as seen in section 7, the antennal and optic lobes of the brain are indicated, but the central body and mushroom bodies are not yet differentiated. In a plane lying in front of the optic and antennal lobes, the brain is divided in each hemisphere into two regions or lobes, *i. e.*, an upper and lower cerebral lobe. From these embryonic cerebral lobes, are eventually developed

[1] Compare the 2d Report of the U. S. Entomological Commission, Pls. XII,-XIII.

the central body and the two mushroom bodies. The stratum of cortical ganglionic cells is, at this period, quite distinct from the paler unstained granular brain matter. The ganglionic cell-portion gradually passes into the central white brain substance, which is composed of fine granules or nuclei alone, and which do not apparently differ from the granules scattered among the ganglion cells. It is to be observed that there are no fibers among the granules. It thus appears that the brain of insects, like the other ganglia, originally consists of a paler portion formed of fine clear granules (nuclei ?), enveloped by a thick, irregular layer of nucleated cells, containing fine granules outside of the nucleus.

As the fibers of the adult brain are evidently secondary products, it would appear that they must be transformed granules or nuclei, and not in all cases, at least, the fibers thrown off from the ganglion cells, although at this time the ganglion cells have no fibers, the fibers of those seen in the adult brain being also secondary growths. It may be that the white inner granulo-fibrous matter of the adult brain is (1) made up of modified granules, which in some cases remain such, and in others form fibers, and (2) of fibers sent in from the cortical ganglion cells.

Comparison of the Brain at this Stage with the first Thoracic Ganglion.—If we compare at this stage of development of the nervous system the brain with one of the ganglia of the trunk, we shall obtain a fair idea of the primitive difference between the brain and one of the ordinary ganglia. By a glance at the figures of the two it will be seen that the organization of the thoracic ganglion is essentially simple. It is divided into two portions or regions. The central granular region is enveloped by a thick stratum of cortical ganglion cells. The whole ganglion in section is rudely hour-glass-shaped and much smaller than the brain. There is no differentiation into distinct lobes as in the brain. The formation of the brain, as is well known by embryologists, is one of the earliest steps in the development of the nervous system, the entire system being at an early date in the life of the embryo set apart from the epidermis or integument, the latter with the nervous system originating from the ectoderm or outer germ-layer.

Second Embryonic Stage, B.—In embryos more advanced, and just ready to hatch, the eyes being now dark red, the central body is formed, but our sections do not show any traces of a mushroom body. The sections are frontal, and we will describe them in order. The fifth section is through the head and front part of the eyes, but does not graze the brain itself.

Section 6 passes through the outer portion of the optic and antennal lobes, now clearly differentiated.

In section 7 the cerebral lobes are seen, and in section 8 are larger, as are the optic lobes, while the antennal lobes are somewhat reduced in size. Section 10 passes through the cerebral lobes and also grazes the optic lobes, passing through the optic ganglion.

Section 11 shows the central body, separated from the upper cerebral lobes by a thin layer of loose ganglionic cells. The relation of the central body to the upper and lower cerebral lobes is well shown in this section.

Section 12 passes through the lower cerebral lobes and the upper left cerebral lobe and the optic ganglion. The œsophagus is situated beneath the cleft under the lower cerebral lobes. The next section (13) passes behind the brain, not touching it. These sections are $\frac{1}{500}$ inch thick.

Structure of the Subœsophageal Ganglion.—In its form this nerve center is more like the brain than the first thoracic ganglion. The figure is drawn from the youngest embryo observed. The ganglion seen in section is very much larger and quite different in shape from the thoracic ganglia. It expands above the lower fissure between the two sides, being very deep and narrow, while the superior furrow is broad and shallow. The internal paler portion (when magnified 400 diameters) is seen to consist of granules. The stratum of outer cells (the future ganglion cells) is thickest on the outside of the upper part of the ganglion, and at the base of each hemisphere.

The Brain of the freshly-hatched Larva of C. spretus.—In the larva but a few hours after hatching, the brain, so far as I can learn from four sections, does not essentially differ from that of the embryo just before hatching, as the interval is apparently too short for a decided change to take place. It is evident that by the end of the first larval stage the brain attains the development seen in the third larval state of the two-banded Caloptenus.

For illustrations of the different larval and pupal stages of development of the locust, the reader is referred to the first Report of the Commission (Plates I, II, III).

Third Larval Stage of Caloptenus bivittatus.—In the third larval condition of another species, the common *Caloptenus bivittatus* of our gardens, the different parts of the brain have attained nearly the same structure and proportions as in the adult. Pl. XIII, Fig. 1, of the second report represents a section passing through the front of the brain, and also the lateral ocelli and the right eye. The ganglion cells surrounding and filling the calices are smaller and more crowded than elsewhere. The mushroom bodies are now formed, though the trabeculæ are not to be seen in our section, but the entire double stalk and calices are very clearly seen. The fibers from the stalk are observed to extend along the inner edge of each calyx and to suddenly stop just beyond the middle. The granular calices contain slight irregularities and sinuous lines, as shown in Fig. 2, *i. cal.*, *o ca.*, but to what these appearances are due it is difficult to say; there are also a few scattered large granules. As the section passes through the front of the brain, where the hemispheres are separated by the frontal furrow, the lobes are not well marked, but the substance is made up of irregular intercrossing bundles of fibers, with the interspaces filled with granulated matter. In Fig. 3 the regular saucer-like form of the calyx is well shown. Fig. 2 is an enlarged view of the right side of Fig. 1, and at this stage large important bundles of fibers are seen passing into the optic, antennal, and commissural lobes.

First Pupal Stage of Caloptenus spretus.—My sections are too imperfect to describe, but the form of the brain is closely like that of the next stage.

Second or last Pupal Stage of Caloptenus spretus.—A number (14) of very successful sections, made by Mr. Mason from one head, give an excellent opportunity for studying the head of the locust in this stage, just before becoming fledged (see first Report, Pl. I, Fig. 5). Of these sections, Nos. 8 and 9 pass through the calices and œsophageal lobes, but do not reach the central body. Section 10 (Fig. 1, of Pl. IV) passes through the central body, which is $\frac{1}{500}$ of an inch in thickness, the section itself being of the same thickness. In the optic ganglion the section passes through the front of it, but two lenticular masses appear. The trabeculæ are as in the adult, and the superior and inferior intra-trabecular nerves are clearly seen to pass into the center of each trabecula just as in the adult. On the left side the origin of the cauliculus and peduncle is clearly seen, under a power of 225 and of 400

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diameters, the relation of parts being exactly as in the adult (see Pl. II, Fig. 3). The base of the two divisions of the double stalk arise suddenly, as if inserted into or resting simply upon, rather than arising from, the trabeculæ; the bases of the cauliculus and peduncle being in the same line with the base of the center of the upper division of the central body. It appears as if a few nerve fibers passed under the base of the stalk between it and the trabecula; at any rate, I have been unable to observe either in the pupa, or larva, or adult among a number of preparations, any continuity between the trabeculæ and the double stalk.

In this section the curving of the double stalk backwards and the passage in front of this double column is to be clearly seen, and is just as we have described it from similar sections of the adult brain (Fig. 3 of Pl. II). The ball-like masses in the œsophageal commissures are as distinctly shown as in the adult.

Section 11 passes behind the central body, not showing it nor the basal part of the double stalk of the mushroom body. This section, and those behind it, show well the structure of the optic ganglion. In section 11 the three lenticular bodies clearly appear.

The main, and almost the only difference between the second pupa and the adult appears to be in the degree of development of the central body. In the second pupa (Pl. IV, Fig. 3) it is rather more elementary than in the adult, the upper and lower series of unicellular bodies being a little shorter and rounder, nearer their primitive condition, and the septa between them are plainly fibrous. Their contents are as finely granular as the adjoining parts of the body.

Section 11 is instructive as showing a bundle of directly ascending and obliquely ascending fibers from the back part of the trabecula, of which a portion is contained in the section. Two large bundles enter the commissural lobes, one from above and one from the inner side under the central body, the bundle from above passing down into the lobe from around the upper side of the trabecula. From this fact we should infer that there is a partial nervous communication between the trabeculæ and the commissural lobes. The fibers enveloping the trabecula above are more numerous, the mass of fibers much thicker than in section 10, showing that what we supposed to be fibers separating the stalk from the trabecula appear to be really such.

A broad bundle of fibers is also seen on the right side, passing down from the upper side inside of the upper end of the peduncle, down outside and back of the central body, and is seen to enter the commissural lobe on its inner side, terminating at the point where the ascending fibers to the upper side of the trabecula originate. There is thus a direct communication between the upper part of the brain and the œsophageal commissure in the lower part. It appears, also, that three large nerves or bundles of fibers enter each commissural lobe from above.

At the under side of the commissural lobes the cortical ganglion cells (some of them very large) appear to send their fibers into others to build up the mass of fibers enveloping the lobe. Flōgel states that the opinion that the ganglionic cells in winged insects are in direct relation through the fibers with the organs of the body are unfortunately provisionally contradicted by his observations. But here (seen in a portion of the commissural lobe not represented in Fig. 3 of Pl. III), as in one or two other places, we think we have seen fibers from the cortical ganglion cells passing into and aiding in building up the nerves. Such a relation is very plain in the brain of the horseshoe crab, *Limulus polyphemus*.

EXPLANATION OF PLATE IV.

FIG. 1.—Enlarged view of brain and eye of *C. spretus* in the second pupal stage; × ½ A. This view of the brain is taken from the same preparation (No. 10) as Fig. 1, Plate V. *Centr. b.*, the central body, showing the two series of cells in the lower division and the two rows of unicellular bodies in the superior division; *œ. com. l.*, œsophageal commissural lobes, with the ball-like masses distinctly seen, though this preparation was stained only with picrocarmine; *œ. com.*, œsophageal commissure; *opt. nvl.*, optic nervules; *retina*, retina with rods and cones beyond, the cornea not shown.

FIG. 2.—The central body of adult *C. spretus*, from section 17, showing the inferior and superior divisions, the cells in inferior division (*inf.*), and the two rows of unicellular bodies (*ce. cell. b.*) in the superior division (*sup.*). Magnified 225 diameters.

FIG. 3.—The central body of the second or last pupal state, from section No. 10; *c*, cells in the fibrous septum between the lower and upper divisions of the central body, from section No. 11. × 225 diameters.

FIG. 4.—Vertical section of the subœsophageal ganglion of the cockroach (*Blatta orientalis*), showing the commissure on the left side.

FIG. 5.—A section farther behind, showing the back of the ganglion (*gang.*) of the cockroach, seen separate from the commissure (*com.*).

FIG. 6.—A section through the commissure just behind the ganglion of the cockroach.

EXPLANATION OF PLATE V.

FIG. 1.—Frontal section No. 10, through the head of second or last pupal stage of *C. spretus*, passing through the middle of the brain, the optic ganglion and eyes,

and cutting across the œsophagus. Drawn in order to show the relation of the brain to the eyes and the exterior of the head; magnified 30 diameters. In the brain, the right mushroom body is seen, while the optic and antennal lobes are not so well marked. The central body (*centr. b.*) is cut through near the middle; below are the trabeculæ (*trab.*); next to the commissural lobes, two tracheæ (*tr.*) or air-tubes passing near the brain. The commissure to the subœsophageal ganglion is drawn on the right side, passing down the œsophagus. In the eye, the cornea, the respective portions composed of rods and cones, the black retina, the stratum of optic nervules, and the optic ganglion and optic nerve passing off from the optic lobe, are all well marked.

FIG. 2.—Section through the brain and eyes of the same second pupa of *C. spretus*, passing through the anterior part of the calices, but not through the central body. The section is oblique and does not well represent the right side.

FIG. 3.—Calyx of the section represented by Fig. 2; magnified 225 diameters. It is composed of granulated nerve substance with a few fibers, the continuation of those of the stalk, and with a few ganglion cells.

FIG. 4—Section through the back of brain of the adult *Locusta carolina*, passing behind the mushroom body, showing the œsophageal commissures, the antennal lobes, and the bundle of nerve-fibers crossing to the right hemisphere. The left calyx is cut through, the microtome-razor passing behind and not grazing the right mushroom body. The distribution of the large (*l.g.c.*) and small ganglion cells (*sm. g. c.*) is well seen in this section. It will be seen that the brain of *Locusta carolina* does not differ in any respect from that of *Caloptenus spretus*, so far as the sections show.

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EDITORS' TABLE.

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

—— It is rumored that at the next meeting of the American Association for the Advancement of Science, to be held in Cincinnati in August of this year, a proposition will be brought forward to extend an invitation to the British Association to depart from their usual custom so far as to come over to this country in 1883, and hold their annual meeting for that year in conjunction with the American Association, at some place hereafter to be fixed upon. A number of the most prominent scientific men in the States and Dominion are known to be in favor of the plan, and doubtless the members of our Association will be glad to send such an invitation as a mark of our cordial feelings towards the students of science in the mother country. It will give us great pleasure if it should prove practicable for the English body to accept. We hope that the proposition may be happily successful. The advantages of such a gathering of scientific men from two countries having a common language, are as evident as they are great. The meetings of the American Association have proved of inestimable value by bringing the investigators of the continent into personal contact with one another. Every scientific man has not only new facts to present, but also theories and hypotheses which may not be sufficiently complete, or justified by positive knowledge, to be put into print, yet it is precisely these vague ideas which are the most valuable stimulants of discovery, because they are the store from which new and sound ideas can be selected. By no other process can this selection be rendered so efficient as by personal discussion with others whose studies are in the same direction. If the suggested meeting be actually held, it will certainly prove as profitable as delightful. There is no room to doubt that on our part we would be lavish of pains to make the meeting successful, and we think our reputation for hospitality is a guarantee that our guests will have a pleasant as well as a profitable visit.

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RECENT LITERATURE.

GENTH AND KERR'S MINERALS OF NORTH CAROLINA.[1]—It is perhaps not generally known to the readers of this journal, that the State of North Carolina has nominally carried on a geological survey continuously for a greater number of years than any other of the United States. The bill under which the present State geologist was appointed, and in substance has carried on his survey, was enacted during the legislative session of 1851–52. Professor Ebenezer Emmons was appointed State geologist in 1852, which office he held until his death, in 1863. His son Dr. E. Emmons, Jr., was then nominated, while the present incumbent, Professor W. C. Kerr, was appointed in 1864. It is of course obvious that little or no geological work proper was done or could have been done from 1860 to 1866. It is not our purpose here to refer to the various reports of Professors Emmons and Kerr, published at different times during the progress of the survey, but to call attention to the advance chapter of the report now being published.

Professor Kerr has been exceedingly fortunate in this and preceding publications, in being able to secure the assistance of one who is *facile princeps* of chemical mineralogists in America.

Of the economically important minerals found in North Carolina in sufficient abundance to be subject to exploitation we may mention gold, which has been found in the gravel deposits, and in the quartz veins of the granitic, gneissic, and dioritic rocks and various slates of the country. It is generally alloyed with silver and occurs associated with limonite, pyrite, chalcopyrite, galenite, sphalerite, tetradymite, arsenopyrite, and rarely with altaite and

[1] *The Minerals and Mineral Localities of North Carolina*, being Chapter 1 of the Second Volume of the Geology of North Carolina. By Professors F. A. Genth and W. C. Kerr, Raleigh, 1881.

nagyagite. The present writer remembers having seen a very beautiful specimen of calcite veinstone well filled with sheet gold, said to have come from North Carolina. The occurrence of gold in calcite veins is very rare, but as the possessors of this specimen supposed the veinstone was quartz, such associations may not be as rare as they are now regarded. We hope that Professor Kerr will endeavor to ascertain if such veins are to be found in the State.

Galenite, sometimes argentiferous, exists in considerable quantity. Chalcopyrite is very abundant and is the only copper ore occurring in sufficient quantity to be relied upon in mining. Some of the copper mines, as for instance the Ore Knob, in Ashe county, are quite well known throughout the country.

Corundum, in association with the peridotite of North Carolina, is quite abundant. It occurs massive in beds from 10 to 14 feet thick, associated with prochlorite, also in hexagonal pyramids, varying from colorless to yellow, deep red, and rarely green shades. It has been mined to some extent, and since, for certain purposes in the arts, the crushed corundum is more valuable than the imported emery, it is to be hoped that the industry will flourish.

Hematite and magnetite are abundant and valuable, while chromite is quite common in connection with the peridotite.

The muscovite mica found in North Carolina has been quite extensively mined since 1868, and is celebrated throughout the United States. According to Professor Kerr, it occurs in eruptive (intrusive) granite dikes in gneisses and mica schists. We would suggest that the term *dike* be used instead of *vein* when speaking of such intrusive forms. We are aware that Professor Dana sanctions the use of the term *vein* in this way, *i. e.* for narrow dikes, but it seems to us that less confusion would result if the word *vein* was only used for the non-eruptive veins. A valuable paper by Professor Kerr on these "mica veins," as he calls them, can be found in the recently published volume of the Transactions of the American Institute of Mining Engineers (1880, VIII, 457-462).

Of minerals whose occurrence is of more especial interest to mineralogists than to the economic geologist, either from their rarity in the State or uselessness in the arts at present, we may mention platinum, found in grains in the gold bearing sands, palladium and the diamond. The latter mineral has been repeatedly found in the State in the gold bearing gravels derived from the gneissic rocks, but never in the itacolumite or its débris. Bismuthinite, tetradymite, argentite, altaite, bornite, chalcocite, barnhardtite, and nagyagite are found, the latter being exceedingly rare, having heretofore only been observed in Hungary.

Again, we may call attention to the presence in the State of covellite, cerargyrite, cuprite, melaconite, spinel in its varieties pleonaste, hercynite, and picotite; gahnite, uraninite, rutile, in beautiful crystals, octahedrite, brookite in the gold sands, braunite, hausmannite, diaspore, senarmontite or valentintite, bismite, molybdite, enstatite, spodumene, arfvedsonite, beryl abundant and often in beautiful forms, zircon, vesuvianite, allanite, zoisite (thulite), fibrolite, cyanite, topaz of the variety pycnite, euclase, titanite, chrysocolla, pyrophyllite, glauconite, genthite, margarodite, paragonite, culsageeite, kerrite, maconite, willcoxite, margarite, dudleyite, uranotil, uranochre, zippeite, hatchettolite, tantalite, columbite, yttrotantalite, samarskite, euxenite, æschynite, rutherfordite, fergusonite, rogersite, xenotime, pyromorphite in variously colored handsome crystals, monazite, vivianite, olivenite, pseudomalachite, lazulite, scorodite, wavellite, pharmacosiderite, dufrenite, phosphuranylite, autunite, wolframite, scheelite, cuproscheelite, stolzite, anglesite, crocoite, montanite, rhodochrosite, cerussite, azurite and succinite.

It will be seen from the above lengthy list that North Carolina is exceedingly rich in rare minerals; the whole number of minerals now found reaching to 178 species, said to be a greater number than has been observed in any other of the United States. While this indicates great industry and care on the part of the State geologist, we can but think that so many being known is largely due to the great knowledge of rare minerals possessed by Dr. Genth and his skill in detecting them.

The remaining chapters of the volume will be looked for with interest, and we hope that North Carolina will continue the good work.

We may remark, in conclusion, that it would be a great advantage to those States which cannot afford the expense of an elaborate survey, and a saving to their citizens, if they would employ some competent, honest, economic geologist, either part or all of the time, to look after the development of the various mining industries, and place on record such geological facts as he may be able to ascertain. Such a survey as that of Professor Kerr's is not expensive, and is productive of great good in developing the mineral wealth of and in attracting capital to the State, as well as in preventing the foolish and ignorant expenditure of mony on worthless property. Brilliant examples of this last have been shown in some of the Northern States during the past few years, which might have been saved if there had been some *competent* State geologist, or commissioner of mining in them.—*M. E. W.*

MARTIN'S HUMAN BODY.[1]—This work is in the mode of treatment of the subject intermediate between the physiologies of Dalton and of Foster, with valuable features of its own. It gives sufficient information concerning the anatomy of the human body to enable the student to appreciate how that body performs its various

[1] *The Human Body.*—An account of its structure and activities and the conditions of its healthy workings. By H. Newell Martin, D.Sc., Professor of Biology in the Johns Hopkins University, etc. American Science Series. New York: Henry Holt & Co. 1881. 12mo, pp. 621, 34. $2.75.

functions. We like the plan of the book, which bears marks of care in preparation and cautious treatment, while the statements are made in a clear simple way, which will make the book of use to advanced college classes, but more especially to teachers. So vast at the present day is the science even of human physiology, so much has been worked out of late, that it is difficult to put in a convenient compass all the information which the student, and more especially the teacher, should have. Where it has seemed profitable, hygienic topics have been treated briefly, and in an appendix the subject of reproduction and development, with their practical bearings, has been well, briefly and sufficiently discussed. The book is sold with or without the appendix. The work is well rounded, comprehensive in its treatment, and as the latest work of the kind is commended to students as well as to teachers. The illustrations are good and sufficiently abundant; a fair number are original.

VERRILL'S CEPHALOPODS OF THE EAST COAST OF NORTH AMERICA.[1]—This paper contains descriptions, accompanied by excellent lithographic plates, of the different cephalopods discovered in 1880 by the dredgings made by the Coast Survey and the U. S. Fish Commission. Until lately it was not suspected that we had such a rich assemblage of these interesting animals upon our coast, but thanks to the liberal spirit shown by the U. S. Coast Survey and the U. S. Fish Commission, government aid has extended and fostered the labors of the naturalists interested in these studies. All of the species mentioned in this paper, with one exception, are new to science; four of the genera are new, and all the forms inhabit depths off our coast from about 100 to 1632 fathoms.

The drawings illustrating Professor Verrill's descriptions were made by Mr. Emerton; the subjects are difficult to render, but probably no more truthful delineations of these animals have ever been published than these illustrating this brochure.

MINOT'S STUDIES ON THE TONGUES OF REPTILES AND BIRDS.[2]—This memoir consists mainly of a description of the soft parts of the tongue of the mocassin snake *(Ancistrodon piscivorus)*, with the addition of observations on the tongue of the rattlesnake, the common garter-snake, with two lizards, chameleon and *Ameira surinamensis*, and the mocking-bird. Hitherto nothing has been

[1] Report on the Cephalopods, and on some additional species dredged by the U. S. Fish Commission Steamer *Fish Hawk*, during the season of 1880. By A. E. Verrill. Bulletin of the Museum of Comparative Zoology, at Harvard College. Vol. VIII, No. 5.

Reports on the results of dredging under the supervision of Alexander Agassiz on the east coast of the United States, during the summer of 1880, by the U. S. Coast Survey Steamer *Blake*, Commander, J. R. Bartlett, U. S. N., commanding. Cambridge, March, 1881. 8vo. pp. 17.

[2] Studies on the Tongues of Reptiles and Birds. By Charles S. Minot. (From the Anniversary Memoirs of the Boston Society of Natural History). Boston, 1880. 4to. pp. 20.

done upon the histology of the tongue of these animals, and it is a favorable sign that in this country where so little has been accomplished in histology, that these studies should originate here.

The paper is illustrated by a rather coarse but well-drawn lithographic plate, and photo-engravings in the text. The author's conclusions are rather long and technical for reproduction in these pages, but we can commend the paper as most excellent in its kind and of interest to the many who study birds, and especially so to the very few who are concerned with the reptiles.

NATURAL HISTORY OF COLEOPTERA.—Rupertsberger's "Biologie der Käfer Europas," which was acknowledged in the March number of the NATURALIST, will be of great assistance to the student of the earlier states of the Coleoptera. The European literature of this branch of Coleopterology has become quite extensive since the publication of the well-known catalogue, by Chapuis and Candèze, and it was always a difficult matter to ascertain whether and just where any particular beetle larva had been described or figured. The very handy, well arranged and carefully executed work of Mr. Rupertsberger, who was already favorably known as the author of several valuable papers on the habits and early history of European beetles, does away with the difficulty. The number of species enumerated, of which either the earlier states, or at least the habits, have been described is remarkably large when compared with the small number of Coleopterous larvæ described in our own country.

REPORT OF THE STATE GEOLOGIST OF NEW JERSEY[1].—The annual report of the State Geologist of New Jersey, Professor Cook, contains among other interesting information, a classified catalogue of the iron mines of the Highlands of the State. Also a geological map of the valley of the Passaic river and its surroundings. The upper part of the valley is supposed to have been a glacial lake.

The chapter on surface geology is full of interest. The author, however, rehearses a number of facts which had already been published by Professor H. C. Lewis in his paper on the Trenton gravel, etc., in the Proceedings of the Philadelphia Academy, and adopts a number of the views there set forth as to age of gravels, &c., but without giving credit to the earlier publication.

KINGSLEY'S NOTES ON CRUSTACEA.[2]—These notices contain descriptions of new species of crabs, with rectifications of synonymy and facts in their geographical distribution, based on the collection in the museum of the Academy of Natural Sciences of Philadelphia. The second notice is devoted to a revision of the fiddler-crabs or Gelasimi. The value of Mr. Kingsley's work on this genus con-

[1] *Geological Survey of New Jersey.* Annual Report of the State Geologist for the year 1880. 8vo. Trenton, John L. Murphy.

[2] Carcinological Notes, No. 1, 2, 3, 4. From the Proceedings of the Academy of Natural Sciences, Philadelphia, 1880. 8vo. pp. 34–37, 135–155, 179–224.

sists mainly in the reduction of species of this large group, and his work bears evidence of care and judgment. It is accompanied by two plates giving outline figures of the "hands" of these crabs. The third notice comprises a revision of the genus Ocypoda or sand-crabs, and here the author has no doubt wisely reduced the number of nominal species of the genus. In the fourth series of notes is given a synopsis of the Grapsidæ.

RECENT BOOKS AND PAMPHLETS.—Das System der Medusen. Erster theil einer monographie der Medusen. Von Dr. Ernst Haeckel. 1 Vol., folio, pp. 672, plates 40. Jena, 1879. From the author.

The structure and affinities of Euphoberia Meek and Worthen, a genus of Carboniferous Myriapoda. By S. H. Scudder. (From Amer. Journ. Sci., Vol. XXI, March, 1881.) pp. 5. From the author.

The stomach and genital organs of Astrophytidæ. By Theodore Lyman. (Bull. Mus. Comp. Zool., Vol. VIII, No. 6.) pp. 9, plates 2. From the author.

On the temporal and masseter muscles of Mammals. By Harrison Allen, M.D. (Proc. Acad. Nat. Sci., 1880.) pp. 12. From the author.

On a new species of Iguanodon found in the Kimmeridge clay. By J. W. Hulke. (From the Quart. Journ. of the Geol. Soc., Aug., 1880.) pp. 26, plates 3. From the author.

The mineral resources of the Hocking valley. By T. Sterry Hunt, LL.D. 8vo, pp. 152, and one map. 1881. From the author.

The Development of the Squid, Loligo pealii Les. By W. K. Brooks. (Anniv. Mem. Boston Soc. Nat. Hist.) 4to, pp. 22, plates 3, 1880. From the author.

Studies on the Tongue of Reptiles and Birds. By C. S. Minot. (Anniv. Mem. Boston Soc. Nat. Hist.) 4to, pp. 20, one plate, 1880. From the author.

Die Jungen Ablagerungen am Hellespont. Von Frank Calvert und M. Neumayr. 4to, pp. 22, two plates, 1880. From the authors.

Second Annual Report of the Department of Statistics and Geology of Indiana. 8vo, pp. 544, plates 11, one map, 1880. From the department.

Monographie des Mammifères Fossiles de la Lombardie. Par M. Emile Cornalia. 4to, pp. 95, plates 28. Milan, 1858–71.

Carattere marino dell'Amfiteatro morenico del lago di Como. Per A. Stoppani e G. Negri. 8vo, pp. 77. plates 4. Milano, 1878. From the authors.

Mission Scientifique au Mexique et dans l'Amérique Centrale. Recherches Zoologiques. Troisième partie. Etudes sur les Reptiles et les Batraciens. Par MM. Auguste Duméril et Bocourt. Folio, pp. 441–488, plates 6. Paris, 1881. From the authors.

Gaceta Cientifica de Venezuela. Año IV, No. 1, Feb., 1881. Carácas. From the editor.

Notes on Liberian Coffee. By D. Morris. Folio, pp. 14. Jamaica, 1881. From the author.

Biennial Report of the State Geologist of the State of Colorado, for the term ending Dec. 31, 1880. 8vo, pp. 75. Denver, 1881. From the State geologist.

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GENERAL NOTES.

BOTANY.[1]

ON THE EVAPORATION OF WATER FROM LEAVES (TRANSPIRATION).—The following investigations, made by Miss Ida Twitchell, in the Botanical Laboratory of the Iowa Agricultural College,

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

during the year 1881, are important as throwing light upon the nature of plant evaporation, and its dependence upon light and heat. Dehérain's experiments (*Chimie Agricole*, p. 175) appear to indicate that the evaporation of water by the leaves of plants takes place almost as freely in a saturated atmosphere as in the open air, evaporation being regarded as a strictly vital process. As the accuracy of Dehérain's results depend upon the perfect saturation of the air in his experiments, some careful experiments were first made upon so-called saturated atmospheres. Wet sponges were placed in bell jars and were found to continue to lose water by evaporation long after the moisture began to condense upon the sides of the bell-jars. A psychrometer was next placed under a bell-jar which fitted tightly upon a ground glass plate. A number of saturated sponges were placed in the jar also. The humidity as shown by the psychrometer rose from 71 per cent. at the beginning of the experiment (8.55 A. M.) to 95 per cent. fifteen minutes later. It remained at or near this point for nearly eight hours (7 hrs. 55 mi.), when at 5.10 P. M. saturation was reached, both thermometers indicating 84° F. During the experiment the temperature gradually rose from 73° F. (dry) to 84½° F. at 4.20 P. M., the two thermometers differing then but half a degree. At 5.10 P. M. the temperature dropped half a degree, when complete saturation was for the first time reached. These observations show that perfect saturation is obtained with considerable difficulty, as the experiments upon leaves are ordinarily performed, and they indicate that it is desirable to carefully review the whole question of plant evaporation.

As one step in this review, the following experiments were made to determine the nature of the influence of light and heat upon evaporation from leaves. A glass bottle with two openings was filled with water, the temperature of which was varied to suit the requirements of the experiment, and to keep the temperature more nearly constant this bottle was set into another glass jar filled with water having the same temperature. A thermometer was placed in one of the openings, and through the other a six-inch test-tube was thrust up to its top. Into this test-tube a cork was fitted, which was covered with tinfoil to prevent its absorbing moisture. This was the weighing cork, and had a loop of platinum wire attached to it, by means of which the whole could be hung upon the hook of the weighing scales. Another cork was similarly prepared, and then split open and a healthy leaf of Orchard Grass (*Dactylis glomerata*) placed carefully between the two halves. By means of tinfoil and putty the cork was rendered impervious to moisture, while not interfering with the healthy and normal action of the leaf, which was still attached to the plant.

The test-tube, with a small thermometer in it, and the weighing cork in place, was then accurately weighed and put into one of the openings of the bottle and allowed to remain there until the small thermometer remained constant at about the temperature of the surrounding water. The weighing cork was then quickly changed for the one attached to the grass leaf. After leaving the grass leaf in the test-tube for half an hour, the weighing cork was put in place again, and the test-tube weighed, care being taken to remove completely all the external moisture. The following table embraces the results. The weights are given in grams and decimals, and the temperatures in degrees of Fahrenheit's thermometer. The same leaf was used in all the experiments, excepting Nos. 16 and 17. The observations were continued through several days.

	Light.	Temperature.	Weight of empty tube.	Weight of tube after ½ hour.	Increase (=water evaporated).
1	Sunshine	45–52	25.8700	25.8853	0.0153
2	"	41–45	25.8670	25.8814	0.0144
3	"	45	25.8665	25.8780	0.0115
4	"	50	25.8650	25.8739	0.0089
5	"	43–48	25.8619	25.8713	0.0094
6	"	48	25.8619	25.8763	0.0144
7	"	43–48	25.8615	25.8723	0.0108
8	"	68–72	25.8605	25.8703	0.0098
9	"	95	25.8308	25.8460	0.0152
10	Diffused light	41	25.8695	25.8700	0.0005
11	" "	59	25.8632	25.8655	0.0023
12	" "	59	25.8627	25.8643	0.0016
13	Leaf in darkness	41	25.8667	25.8688	0.0021
14	Whole plant in darkness	61	25.8615	25.8615	0.0000
15	Whole plant in darkness	61	25.8615	25.8619	0.0004
16	Sunshine	93	20.4408	20.5036	0.0628
17	Darkness	95–97	20.4402	20.4420	0.0018

A careful study of the foregoing table shows that the leaf invariably lost more water in sunshine than in darkness. The question now arises whether it is the light, or some accompaniment of it which in these experiments produced the evaporation. If the light, it must be through some vital activity of the plant, for light itself can not directly promote ordinary physical evaporation. We here come squarely upon one of the questions in dispute among vegetable physiologists, one party holding that the evaporation from plants is a purely physical phenomenon, exactly like the evaporation from any other moist substance, the other, including Dehérain, that it is different from ordinary evaporation in that the vitality of the plant controls it; or in other words, the two views may be expressed by saying that on the one hand it is regarded as a *physical* action, and on the other as a *vital* one.

A pine splinter from a board was now cut into about the size and form of a grass leaf, and after being soaked in water until saturated, it was fastened into a cork exactly as the grass blade had been, and a number of observations were made upon it to see whether it would respond to the changes in light as the grass leaf had. The results are given in the table below:

	Light.	Temperature.	Weight of empty tube.	Weight of tube after ½ hour.	Increase (= water evaporated).
1	Sunshine	63–68	20.4437	20.4717	0.0280
2	"	90	20.4418	20.5120	0.0602
3	Darkness	97–74	20.4418	20.4450	0.0032
4	"	109	20.4430	20.4480	0.0050
5	"	61–97	20.4425	20.4439	0.0014
6	"	99–120	20.4422	20.4471	0.0049

Here we had, without doubt, a purely physical action, and yet the evaporation was about ten times as great in light as in darkness. Now, light itself could not have been the cause of this increased evaporation in this case, and it is a just inference that it was no more the cause in the previous experiments upon the leaf.—*C. E. Bessey.*

THE FLORA OF ARKANSAS.—From the geological formations, varied surface features and central geographical position of Arkansas, one would expect to find a flora rich in genera and species.

The State embraces Silurian, Sub-carboniferous, Cretaceous, Tertiary and Quaternary formations. The surface comprises mountains, uplands, prairies, alluvial bottoms and swamps.

Geographically it is so situated as to invite the floras of the States on the north-east, south and west, and also has a flora of its own.

These important elements, favoring plant occurrence and distribution, combine to make the botany of Arkansas interesting, and the species numerous and varied. A few instances will serve to show the richness of the flora of Arkansas as compared with that of Iowa, which lies on the same side of the Mississippi river, but some degrees further north.

There are 34 species of the order Rosaceæ in Iowa, while the order is represented in Arkansas by 35 species. There are 208 species of Compositæ in Arkansas and only 156 in Iowa; 18 species of the genus Quercus in Arkansas, only 10 in Iowa; 110 species of grasses in Arkansas, only 90 in Iowa. The genus Carya is represented in Arkansas by all the 8 species found in the United States, while only 4 are recorded from Iowa.

The flora of Arkansas is represented by all the orders found in Iowa and in addition by Magnoliaceæ, Droseraceæ, Calycanthaceæ, Melastomaceæ, Loasaceæ, Passifloraceæ, Hamamelaceæ, Aquifoliaceæ, Styraceæ, Loranthaceæ, Sauruaceæ, Ceratophyllaceæ, Myricaceæ, Palmæ, Hæmodoraceæ and Bromeliaceæ.

The most of the species found in the adjoining States east of the Mississippi, are also found in Arkansas. The same may be said of the flora of East Texas, Indian Territory and Kansas.

I will close by giving a few of the trees of the gulf and coast flora that are found in South Arkansas, viz: *Magnolia glauca* L., *Sapindus marginatus* Willd., *Nyssa uniflora* Wang., *Fraxinus platycarpa* Michx., *Olea Americana* L., *Persea Carolinensis* Nees, *Carya myristicæformis* Nutt., *Quercus aquatica* Nutt., *Q. Phellos*, L., and *Pinus Tæda* L.—*F. L. Harvey, Ark. Ind. Univ., Jan. 13, 1881.*

Botanical Notes.—M. E. Jones, of Salt Lake City, well known as a collector of western plants, has recently sent out a printed list of his second fascicle of Utah plants. It includes about four hundred and fifty species, many of which are rare and interesting.——Grawitz has recently shown that the moulds Eurotium and Aspergillus possess forms which are highly malignant when they obtain access to the circulatory system of animals. Their spores germinate in the veins and arteries and are carried to various parts of the body, producing death within a few days. The other forms of these fungi do not exhibit this malignity.——In a paper on the preservation of grain in closed vessels, presented to the Paris Academy of Sciences, Jan. 10 and 17, 1881, Muntz announced that the production of CO_2 was but one-tenth as much in air-tight vessels, as when the air had free access. Increase of moisture and of temperature, increase the production of CO_2. The presence of CO_2, although indicating the physiological combination of the material of the grains, is in one sense beneficial, as the asphyxiating gas prevents the attacks of certain insects.——Woronin has been studying the curious Myxomyceteous organism, known as *Plasmodiophora Brassicæ*, which is supposed to be the cause of the hernia of the cabbage.——Dr. Koch has shown, in Cohn's *Beiträge zur Biologie der Pflanzen*, that perfectly dry seeds can withstand a temperature as high as 120° to 125° Cent. (248° to 257° Fahr.), without injury——In the same publication Dr. Miflet details the results of the studies of the Bacteria in the air. The air from a sewer contained an abundance of germs; that from the soil contained a few, while that from a fever hospital contained none, because of the excellence of the ventilation.——Dr. Heilsher has shown (in Cohn's *Beiträge)* that one of the cotyledons of *Streptocarpus polyanthus* is persistent and develops into a perennial foliage leaf.——In *Nature* for Feb. 10, Mr. Francis Darwin reviews at length Dr. Herman Müller's recent work on the fertilization of Alpine flowers *(Alpenblumen, ihre Befruchtung durch Insekten und ihre Anpassungen an dieselben)*.——According to Baron Ferdinand von Müller, the blue-gum tree *(Eucalyptus globulus)* of Australia will endure a temperature as low as 20° or even 15° Fahr. It would appear from this that it might be grown in places in the Gulf States.——J. C. Arthur publishes a valuable paper on "The various forms of Trichomes of *Echinocystis lobata*," in the March *Botanical Gazette*. It is accompanied by a plate with nine figures.——In the March *Torrey Bulletin*, J. B. Ellis hazards the belief that Coleosporium of Solidago (*Uredo Solidaginis* Schw.) is the rudimentary stage of the Dothidea (*Sphæria Solidaginis* Schw.) common somewhat later in the season on the same leaves.——In the same number a translation appears of Dr. Herpell's method of preparing the fleshy fungi for the herbarium. The essential features of the process are these: Stout sheets of paper are coated over with gelatine. The fungus is cut into thin longitudinal sections and these are laid upon a moistened sheet and afterwards placed in an ordinary press. Such preparations are said to retain their colors excellently.

ZOÖLOGY.

NEW TEXAN UNIO.—The following description is based upon a series of shells received from the late Prof. Boll, of Dallas, Texas. They were collected by him in the last trip but one made in the interests of science. With them came a number of other Texan forms, perhaps all referable to described species and of great interest from the light they throw on geographical distribution, and the variations to which the Unionidæ are subject, dependent thereon. It is hoped to make them the subject of a future communication.

Unio bollii (sp. nov.).—Testa lævi, sub-rotunda, ventricosa, subinæquilaterali, postice obtuse angulata, antice rotunda; valvulis crassissimis, antice paulisper crassioribus, postice ad dorsum paululum tuberculatis; natibus subelevatis, tumidis, ad apices valde granulatis; epiderme pallido-lutea usque albofusca aut viridicante, eradiata; dentibus cardinalibus magnis, erectis, acuminatis crenulatisque; lateralibus sublongis, crassis rectisque; margarita alba et postice iridescente.

Shell smooth, rather rounded, inflated, somewhat inæquilateral, obtusely angular behind, rounded before; valves very thick, thicker before, behind on dorsal aspect very little tuberculated; beaks somewhat raised and swollen, much granulated at the tips; epidermis pale yellow to light brown, or greenish, without rays; cardinal teeth large, erect, acuminate and crenulate; lateral teeth rather long, thick and straight; nacre white and iridescent posteriorly. Diameter 1.5 in., length 2.75 in., breadth 3.12 in.

Habitat, Colorado river, Texas. J. Boll. My cabinet, and cabinet of Arthur F. Gray.

Shell smooth, rather rounded, inflated, somewhat inæquilateral, obtusely angular behind, rounded before; substance of shell very thick, thickened anteriorly, on dorsal aspect, posteriorly, a number of small tubercles with a tendency to arrangement in rows; beaks somewhat raised and tumid, much granulated at the tips; ligament long, thick, in color partaking of the general character of the epidermis; the latter pale yellow to light brown, with a greenish cast, without rays, but with very marked darker concentric lines of growth moderately distant, umbonial slope rounded; posterior slope raised and broad, slightly sulcate near dorsal aspect, where are rather numerous small pustules; cardinal teeth heavy, erect, acuminate, crenulate, double in the right valve, with a third accessory small tooth in the sinus of the major divisions, single in the left valve with sinus corresponding to the small third tooth of the right valve; lateral teeth rather long, thick, crenulate and straight; anterior cicatrices distinct, deeply impressed, that of the adductor muscle especially so and extending very nearly to dorsal margin; posterior adductor cicatrix rather deeply impressed, confluent with posterior retractor impression, the latter above, deep, at extreme end of lateral teeth; dorsal cicatrices at unequal distances along the anterior aspect of the cavity of the beaks, the last near the *protractor pedis* impression; pallial impression deep for the anterior two-thirds of its length; cavity of the beaks deep and triangular; of the shell deep and rounded; nacre milky white and iridescent posteriorly.

Observations.—This is a very distinctly marked species, not easily confounded with any other Texan shell. It is, perhaps, allied to *U. quadrans* Lea, but differs in the following constant characters: It is not quadrate, has a much lighter epidermis, heavier teeth, the erect cardinal teeth, the tuberculated posterior slope, the shape and depth of the cavity of the beaks, and the distinct anterior cicatrices.

The species is dedicated to the late Professor Jacob Boll, in memory of his services to science, he having done not a little to foster a love for natural history in his adopted State of Texas.—*R. Ellsworth Call, Des Moines, Iowa.*

NOTE ON SUCCINEA CAMPESTRIS AND S. AUREA.—A gentleman residing in Illinois, recently sent me a number of land and marine shells for determination, collected in November, 1880, in the vicinity of New Orleans, Louisiana, and on the main-land of Florida and Cedar Keys. Among the land shells collected by him at New Orleans, was *Succinea campestris* Say. In Part I, of "Land and Fresh Water Shells of N. A.," published by the Smithsonian Institution in 1869, Mr. Binney assigns as the geographical range of this species the States of Florida and Georgia, remarking that it has been "observed as yet only" in those States. The specimens under consideration are, beyond doubt, *campestris*. Mr. Binney repeats the same remark in Vol. V of his recent "Terrestrial Air-breathing Mollusks," page 427, published in 1878, by the Museum of Comparative Zoölogy, as Vol. IV of its Bulletin. The species was sent me from Charleston, S. C., in the summer of 1877. These two localities will therefore extend its geographical limits both to the north and west. It will probably be found also at intermediate points in Mississippi and Alabama.

In both of the works quoted the distribution of *Succinea aurea* Lea, is limited to the State of Ohio. It is remarked by Mr. Binney, "a species of the interior region, but restricted as far as yet known to Ohio." There are, in my collection, specimens of this beautiful species from three separate localities in that State. But there are also specimens from the interior of New York, collected by me at Richfield Springs, Otsego county, in July, 1877. In the Bulletin of the Buffalo Society of Natural Sciences for August, 1874, is printed a paper on "Land and Fresh Water Shells of the State of New York," by the late Dr. James Lewis. On p. 133, he quotes *S. aurea* from Staten Island on the authority of S. Hubbard, but quotes it with a question mark, and in parenthesis, says, "Probably not authentic." He also quotes the species, on the authority of himself, from Little Lakes, with the remark, "Probably not clearly identified." The locality last named is but a few miles from Richfield Springs, and is in the same county. But, beyond a doubt, *S. aurea* does occur at both of those localities. The specimens collected by me thoroughly satisfied Dr. Lewis that *aurea* really belonged to the New York fauna. He so labeled some I gave him; and a recent very careful comparison with typical forms from Ohio affords conclusive proof of specific accuracy. The geographical limits of this last named species must, therefore, be greatly extended, and made to include Western and Central New York.

It might also be added to these new localities for well known shells, another locality for *Unio pressus* Lea. It was collected by me in the Des Moines river, in August, and in the Nishnabotna river, in the extreme south-west of Iowa, in September last. This species, therefore, ranges from Whitehall, in New York, to Fremont county, Iowa, and may be discovered yet farther west.—*R. Ellsworth Call, Des Moines, Iowa.*

THE ENGLISH SPARROW IN ILLINOIS.—In relation to the curious habit of the English sparrow reported by Mr. Gillman, in the February number of the NATURALIST, attention is called to the following statement, translated from a little book on native German mammals and birds:[1]

"To begin with the spring, we must give especial prominence to the fact that the sparrow, at the very time when it engratiates itself with the gardener as a protector of his fruit trees, also enrages him by wantonly biting off the buds of the leaves and the blossoms. This mischief appears to us to be done chiefly as a pastime, for the bird carries the plucked bud for a long time here and there in its beak, and finally lets it fall.

"Whether the discovery of a worm in a bud * * * does not also, in many instances, induce the sparrow to extend its

[1] *Die einheimischen Säugethiere und Vögel, nach ihren Nutzen und Schaden in der Land und Forstwirthschaft.* Von ADOLF und KARL MULLER. Leipzig, 1873.

search to the soundest buds, is a question which we will not attempt to decide."

The thorough examination of the food and food habits of the English sparrow which is certain to result from the intense and universal interest the little stranger has awakened, will give us a mass of valuable facts for comparison with those accumulated in Europe, where the debate concerning the good and evil of its life has been vigorous and long-continued. We shall thus be able to trace much more fully and exactly, than has ever yet been done, the effects of widely changed conditions upon the alimentary regimen of a bird.

Now that the stage of more or less ignorant and passionate discussions and personal vituperation seems nearly to have passed, contributions of fact will probably not be unwelcome. I add a few notes on the food of twenty-five birds shot in and around Aurora, Ill., in September, of two successive years, 1879 and 1880.

The elements of the food at this time were quite few and simple, consisting almost wholly of fragments of grain picked up on the streets and of the seeds of a few of the commonest grasses. At a time when thirty per cent. of the food of the robin, twenty per cent. of that of the catbird, and ninety per cent. of that of the blue bird consisted of insects, no insects were found in the stomachs of these birds except traces of three grasshoppers, making perhaps six per cent. of the food. Fragments of corn, wheat and oats amounted to about forty per cent., and the seeds of grasses to as much more. The common pigeon grass *(Setaria viridis)* was much the most abundant species; but *S. glauca* and *Panicum sanguineum* occurred quite frequently, and three or four species of Panicum and Eragrostis, which I did not determine, were also present in small quantity. One bird had eaten many hemp seeds, five had taken a very few seeds of "smartweed" (Polygonum), and two had eaten little else than the seeds of the common garden sunflower.—*S. A. Forbes, Normal, Ill.*

The Red-winged Starlings generally leave this region before we have any severely cold weather. After the breeding season is over they congregate in vast flocks, which sometimes almost darken the air. They used to eat our corn in the fields to a damaging extent, but for several years I have heard no complaints on this score. It would seem that they are gradually abandoning this habit, possibly from having found some other supply of food. It used to be customary for the farmers to complain of their depredations and often shoot them. One enterprising legislator even tried to get a law passed, offering a bounty for their wholesale destruction. But better sense prevailed with the majority of the members. During the third week of last December I noticed about a dozen of these birds, which from some cause or other had remained with us. Below a neighboring mill dam the water flowed out, making a small brook. These birds were wading about in the shallow water, apparently in search of something for food. When any one approached too closely they flew into the tree-tops near by, returning as soon as they were left unmolested. They continued this unusual habit for a week or more, but finally left us a few days before Christmas.—*Charles Aldrich, Webster City, Iowa, Jan. 7, 1881.*

THE INDIGO BIRD.—Writers on the ornithology of this section seem to convey the idea that this beautiful little bird (*Cyanospiza cyanea* Baird) is not common here. I think this is an error. I have frequently seen them in spring and early summer, and while I have never looked for their nests, I have had no doubt that they breed in the thickets and groves along Boone river. I used to see one quite often, which appeared to me to be a little trifle lighter in color than those generally met with. The blue was paler. I have seen him and heard him sing for several days in succession, and as I observed his peculiarity of color, there could be little doubt regarding his identity as one and the same bird. This was on the border of a crab-apple and hazel brush thicket, and the nest would no doubt have been found by searching for it. I see them so often about the time of breeding that I have never doubted that this region may be set down as one of their regular habitats.—*Charles Aldrich, Webster City, Iowa, 1881.*

ZOOLOGICAL NOTES.—The process of self-division in *Euglypha alveolata*, a flagellata infusorian, has been observed and illustrated by Dr. August Gruber.——A very large ascidian (*Ciona ocellata* Agassiz) has been discovered by Professor Verrill in abundance on the rocks and wharves at Newport, R. I. It is our largest and most elegant ascidian, but rare and very local in its distribution. It will be remembered that the European *Littorina littorea* was introduced on the shores of Maine, about 1868, but at a much earlier date on the shores of Nova Scotia. During the winter of 1879–80, it was found by Professor S. I. Smith, of New Haven. Two other littoral species of European shells, not before recorded as American (*Truncatella truncatula* and *Assiminia grayana*), were found by Professor Verrill at high water, among the docks at Newport.——Professor Semper's book, entitled The Natural Conditions of Existence as they affect animal life, has been published and will deserve a wide circulation. It is favorably reviewed in *Nature*, by Professor Ray Lankester, who, however, finds fault with the orthodoxy of Semper's Darwinism. It is evident that we are to have sects and sectarianism among evolutionists. We had supposed that Mr. Darwin had modified his own Darwinism, certainly among evolutionists Darwinism, as such, is being replaced by a modern type of Lamarckianism, as in our opinion it should be.——A Hymenopterous parasite has been hatched from larvæ found on two spiders (Linyphia); the larvæ were apodous and adhered to the abdomen of the spider, which, when full-grown, they fully equaled in size.——The embryology of Selachians (Acanthias) has been recently studied by Dr. H. Rabl-Rückhard, of the Berlin Museum, with a view (1) to determine the cephalic ending of the notochord in its relations towards the hypophysis cerebri and the so-called middle trabecula, and (2) the origin of the pineal gland. He finds that at no period has the embryo of Acanthias a notochord with its apex projecting beyond that part of the base of the skull, which subsequently becomes the dorsum sellæ, thus confirming the views of W. Müller, Balfour and Parker; though this view is not irreconcilable with the view of Reichert, that the notochord of young sharks at a certain period of development reaches to the frontal wall. ——As regards the comparison of the brains of the higher vertebrates with the lower, which is in controversy, by ascertaining the true position of the pineal gland, we advance towards a true solution of the difficulty. Rabl-Rückhard confirms the views of Balfour and Ehlers that in sharks this gland is developed just as in higher vertebrates, as Stieda insists, in all higher adult vertebrates it lies dorsally between structures which correspond to the primary first and second cerebral vesicles.——Professor His, studying the question as to the development of a tail in the human embryo, disputes that it has at first a true tail, as it possesses no supernumerary vertebræ, and in pathology no extra number have ever occurred.

ENTOMOLOGY.[1]

Exuviation in Flight.—Mr. R. McLachlan has recorded a remarkably numerous flight of the Ephemerid, *Oligoneura rhenana*, last August, at Basle, Switzerland, with the interesting observation that it casts the subimaginal skin while on the wing. We have often met with just such swarms of Ephemerids as Mr. McLachlan describes, flying either against the wind or against the current of a river. In the case of *Polymitarcys alba* (Say), which is extremely common on the Red river of the north, where in August, 1877, we found it actually giving the river a white appearance, and falling upon vessels like snow, the subimaginal skin was shed in an incredibly short space of time (less than a minute), but was almost invariably preceded by a brief period of rest. The impatience to fly off after the true wings were withdrawn, however, was such that in the large majority of cases the insect took wing before the subimaginal skin was fully cast, in which case exuviation would be completed on the wing. We cannot conceive of the beginning of the process taking place on the wing, for there is a period, however short, from the bursting of the skin on the thorax to the extraction of the wings from their covering, when the use of the wing, it seems to us, is impossible; and we can conceive of full exuviation in the air only on the hypothesis that the insect during the process descends from a sufficient altitude to afford time for the extraction of the new wings.

[1] This department is edited by Prof. C. V. Riley, Washington, D. C., to whom communications, books for notice, etc., should be sent.

ON SOME NEW TUBE-CONSTRUCTING SPIDERS.—While wandering on a bright October day in search of spiders, over the hills on the Virginian shore of the Potomac, near the Aqueduct bridge, I noticed on a grassy place at the border of a pine wood, several small, nest-like structures with a round hole in the center, and was at once aware that I had at last before me the so-long looked for home of a certain ground spider or Lycosa.


FIG. 1.—Nest of *Tarentula nidifex* (Marx del.).

These little nests were about 2 cm. high, composed of bits of grass, little sticks of wood, pine leaves and rootlets, perfectly round and made in very much the same way as an ordinary bird's nest, and of much the same form (Fig. 1). The nest inside was cylindrical and about 2 cm. in diameter.

Removing carefully the little nest, I dug open the shaft and found it to be in some instances 10, in others 12 cm. deep, perfectly round, smooth, perpendicular and without any web lining. But the nest was strengthened inside by a lining, which resembled a very fine tissue paper, so fine that it could hardly be noticed. Under the lens it showed no threads but a more hardened texture, like varnish. This lining holds together the loosely arranged material and enables it to resist rainstorms, floods, snow and all dangers of a stormy winter, for I found several pretty well preserved ones in spring.

At the bottom of this shaft there laid in an unconscious or torpid condition, a large dark-brown spider (Fig. 2) in a semi-erect position. Pulling the spider out with my forceps, it awoke, made some movements and laid down again. I found five additional specimens, and the nests, as well as the shafts, were all constructed on the same plan. In only one instance did I find the bottom part somewhat enlarged.


FIG. 2.—*Tarentula nidifex* ♀ (Marx del.).

Not far away from the place where the above nests occurred, but upon a barren clay ravine, where the rain had washed away all vegetation, I found an apparently newly built structure, which differed from the former ones in the kind of the material used for its construction, for it was built of clay, little stones and few and stronger wooden sticks (Fig. 3). On one side a little colony of lichens was flourishing.

In this shaft, which was wider than the others, I found a very large specimen of the same species. Handling it somewhat carelessly, it awoke, and turning quick around, caught my finger and bit it with such force, that it clung on my raised hand. The pain was intense and about as acute as that from the sting of a wasp, but it disappeared in twenty minutes, while the swelling of the finger and of half the hand, lasted over two hours.

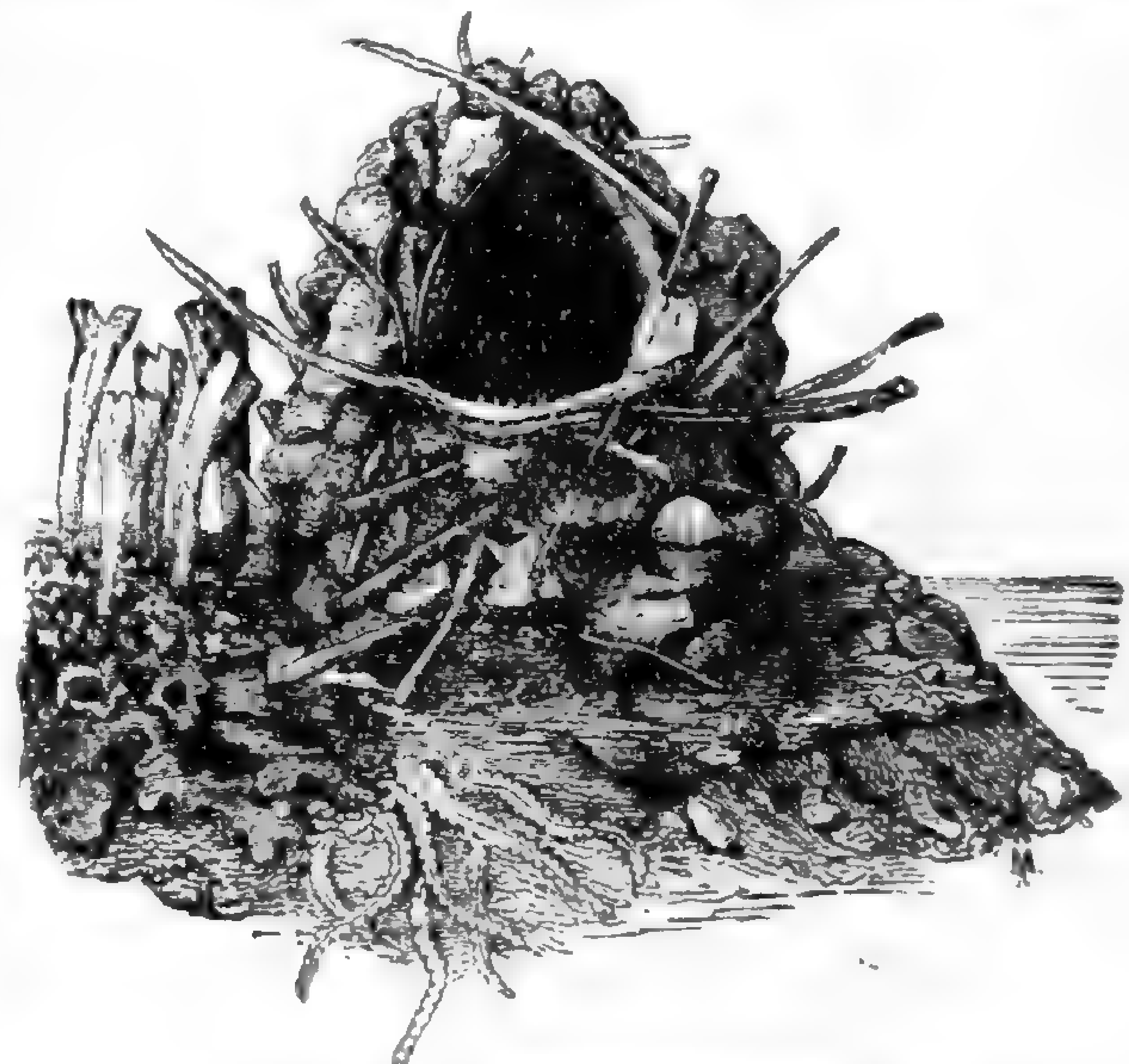

FIG. 3.—Nest of *Tarentula nidifex* (Marx del.).

I brought the spider home and filled a high glass jar three-fourths full of earth, and put the spider in its new home. It laid motionless on the ground, and I thought it was dead, but the next morning I found that it had dug, during the night, a hole 5 mm. deep, which it occupied. The following nights it deepened the shaft more and more until the depth was 12 cm. I strewed little sticks of broomcorn over the ground, and during the night it had placed a few sticks around the hole. Every morning it had added a few sticks, and at the end of the week the nest was complete, measuring 3.5 cm. in height. All her work was performed during the night, and in day time she occupied her new habitation. As it was too early in the season for flies, the poor creature had to fast for three months, during which time she kept herself confined in the shaft. Only when I placed the jar near the stove and the contents got warm, did the spider appear on the top of the nest and rest there, with legs bent under like a cat in the sunshine.

In March I caught the first fly, which was devoured in an instant by the spider outside the habitation. I then fed her regularly with flies, and she would jump up after them. Did the fly come near her she stood erect upon her four posterior legs, and with the four anterior and her palpi, she made rapid sweeping motions towards her mouth, and she got the fly always. One day I placed a watch glass full of water on the ground, and the spider at once made use of it by placing her palpi and front feet in the miniature basin, and then drawing them through her mandibles several times. At last she waded into the basin, where she lay for a quarter of an hour, the whole body except the head being under water. One morning, May 26, I found her dead in the water. The specie seems to be new, and I have called it in MS. *Tarentula nidifex.*

About the same time I received from Mr. Nicolas Pike, of Brooklyn, with whom I had corresponded upon this subject, specimens, in a dried state, of a Lycosa which, according to a statement of this eminent naturalist, digs similar holes in the sand near the sea shore. Mr. Pike speaks thus about the habits of this remarkable spider, to which I have given the MS. name of *Tarentula pikei:*

It makes a hole in the sand from 12 to 15 inches deep (in one instance I found it 22 to 23 inches), perfectly perpendicular, and the depth and diameter vary according to the size and age of the individual. The entrance to the habitation is neatly underwoven with a fine web and particles of sand, which extend down more than an inch from the entrance, where the excavation widens so as to enable the spider to turn more rapidly and retire to the bottom with its prey. The lower part is also enlarged, and is covered as well as the whole length of the tube, with a substance which the spider secretes and which forms a hard, smooth finish to the interior, so that when it runs in and out of the tube not a particle of sand is displaced.

FIG. 4.—Nest of *Tarentula pikei* (Marx del.)

The entrance to the excavation, when inhabited by adults and built on an elevated sand dune, is very neatly thatched with pieces of fiber and the fine grass which abounds on the sea-shore (see Fig. 4). This thatched entrance is ingeniously constructed, and sometimes, not always, interwoven with a fine web, which prevents the loose sand from falling into the hole.

It was some time before I could ascertain the manner in which these spiders construct their curious habitations, as the work is always carried on at night. At last my perseverance was rewarded.

In the summer of 1877 I passed some time at Shinnicook and its vicinity (Long Island). While encamping in a very remote and out of the way place, amongst the sand dunes, where these spiders are numerous, I there had the good fortune to see the operation of building as well as to study the habits of this probably hitherto undescribed spider. In this case a female was the operator. She commenced by removing the sand on the surface till a saucer-shaped excavation was made, about a quarter of an inch deep. This was done by pushing away the sand with her body, and then she commenced to make the excavation proper, with a peculiar rotary movement of her body. The sand was pushed back and a glutinous web was spun, which held back the particles of sand, she at the same time pressing it with her abdomen to the size required until the opening was completed. I could still observe her at work as she constructed the upper chamber (if I may call it so), which occupied much time. After this was finished, I lost sight of her, as the excavation in the damp sand was raised. My observations were made by the dim light of a lantern, as the night was dark and cloudy. It was midnight when I left her and laid down in my rubber blanket, and at dawn the next morning the nest was finished. She had completed it by a thatched ring one and a half inch in diameter. I reluctantly destroyed the nest, but was anxious to examine all its parts. I first tried to get the spider out by inserting a straw, but she would not move. I then carefully removed the thatch and web for preservation, and then dug down to ascertain the depth and structure of the excavation. I found it to be 21½ inches deep, perfectly straight down, and the upper and lower chambers were just twice the size of the main tube, which in this case was seven-tenths of an inch in diameter. There was not a vestige of web, except in the two chambers, as the sand was damp and adhesive.

In the month of June I have found the female on her eggs at the bottom of the tube; these were loosely covered with web and agglutinated sand, similar to the egg bag of the *Lycosa maritima* Hentz. She seldom leaves her eggs, but remains with them till they are hatched, when the young cling to her body till they are about three-eighths of an inch long.

FIG. 5.—*Tarentula pikei* ♂ (Marx del.).

Fig. 5 represents the male, and Fig. 6 the female of this interesting species.

Mr. S. H. Scudder has published in *Psyche* (January, 1877) an account of a tube-constructing ground-spider which dwells in the sandy spots and dunes of Nantucket, and which he calls *Lycosa arenicola*. While the habits differ from those of *Tarentula pikei* (for instance, the shaft is without the widenings in the upper half and at the bottom) and the two species differ in some respect in form and color, they certainly belong to the same genus and are nearly related.

Another mention is made of a spider which makes similar habitations, by that gifted observer, Mrs. M. Treat, of Vineland, N. J., who in *Harper's Monthly* (April, 1880) describes at length its habits, and names the species *Lycosa turricola*.[1]

FIG. 6.—*Tarentula pikei* ♀ (Marx del.).

In conclusion I will state a few facts about the habits of the spider *(T. nidifex)* which I have found, in which it differs from the other three species here mentioned, viz: *T. pikei*, *L. turricola* and *L. arenicola*.

While the discoverers of these three species are unanimous in stating that they have found egg-bags at the bottom of the tubes, I have never found any egg-bag, although I have opened more than twenty tubes in spring and summer. Nor have I noticed any indication that the spider uses this subterranean structure as a home during the time she has to care for her eggs or young ones. On the contrary, I am convinced, for the following reasons, that this species (*Nidifex*) uses this structure only as a safe and secure winter

[1] See also an article "The Lycosa at Home," by J. H. Emerton, in the NATURALIST, Vol. IV, p. 664.—EDITORS NATURALIST.

quarter, and that during the warm spring, summer and early autumn months she lives on the surface:

1. Only during the latter part of October and fore part of November, have I found the newly built nest and chimney-like structures.

2. I always found then, in each shaft, one spider in its winter sleep.

3. In May the structures above ground were, if still existing, in a dilapidated condition, and the shafts unoccupied.

4. In June, July and August, I have never found a single spider "at home," the above ground buildings were in the same unrepaired and dilapidated state.

5. During these months I have found by sweeping the grass and low bushes, three specimens of the spider, and one in an old stump of a sycamore, where she had constructed a web.

As this spider lives in a cultivated place, *i. e.*, grass bottom with shrubbery and trees in abundance near by, she finds her prey outside her shaft, and at the same time, ample opportunity to hide from her enemies under moss, leaves or stones, etc., while *T. pikei* and *L. arenicola*, living without any shelter on the barren sand dunes, are compelled, for safety sake to occupy their under-ground habitations permanently.

Lycosa turricola builds her nest, according to the statement of

FIG. 7—Entrance to nest of *T. nidifex*.

FIG. 8.—Entrance to nest of *T. nidifex*.

Mrs. Treat, upon a pentagonal plan. Now *Tarentula nidifex* uses for constructing her nest a displaced quadrangle or rhomboid (see Fig. 7). When the material for the nest consists of soft and flexible grass blades, the spider bends them round the hole half way (see Fig. 8), but if she uses coarser sticks, she lays them always as is shown in Fig. 7, but if she finds a piece naturally bent, she makes use of the curve by laying it so that the concave side is brought around the hole.—*Geo. Marx, Washington, D. C.*

THE RASCAL LEAF-CRUMPLER IN GEORGIA.—We have received from Mr. J. P. Henderson, Commissioner of Agriculture of Georgia, specimens of this insect (*Acrobasis nebulo* Walsh) reported as doing great injury to the orchards of Mr. James Speir, in Bryan Co., of that State, webbing together the leaves and eating out the buds as they put forth in the spring. Its injuries in the Western States have long been well known, but its appearance in the South has not been so generally recorded.

VERTICAL VS. HORIZONTAL INSECT BOXES.—A. Preudhomme de Borre has published a pamphlet on the "Best arrangement of boxes and cartons of collections of insects." While admitting that as far as space and convenience are concerned, the arrangement of boxes on their edges is advantageous, he claims that for the following reasons it is unwise, viz: (1) Specimens become loose and fall, breaking themselves and their neighbors; (2) or they turn on their pins with similar results; (3) infected specimens are not readily detected by the dust.

Dr. G. H. Horn, of Philadelphia, claims that the objections urged by M. de Borre are due, in a great measure, to the improper boxes used for preserving specimens in France and Belgium, and makes the following arguments against de Borre's objections:

1. The French boxes are made of thick pasteboard, having false bottoms made of *papier maché*, or peat, very rarely of cork. The paste-board is objectionable from the fact of its tendency to lose its shape and become convex, while the peat and *papier maché*, on account of their inelasticity, are unsuitable, the former having the additional bad quality of corroding and adhering to the pins.

2. The danger of the specimens becoming loose may be averted by using shorter pins than the French are accustomed to, and the bottom of the box should be invariably lined with cork of at least one-fourth of an inch in thickness. To prevent the specimen from turning on the pin, dip the pin previously into an alcoholic solution of shellac. In the case of large specimens, slightly flatten the pin by a few blows with a hammer, in addition to coating it with shellac.

3. The presence of infection is readily detected in a vertical box as the dust always falls on the head of the specimen below the infected one.

4. The box for the preservation of specimens should be made of well seasoned pine, nine by fourteen inches and two inches deep, all outside measure. The lining of the bottom should be cork of one-fourth of an inch in thickness, covered with thin glazed paper. In such boxes, specimens may be arranged in the following manner: draw faint pencil lines from one side of the box to the other, dividing it into five or six equal portions, according to the size of the specimens, then beginning at the upper left corner of the box, place four specimens side by side, and so on down that column, and then the other divisions in succession.

INSECTS AFFECTING THE CHINA TREE.—The China tree *(Melia azedarach)* has always been considered as perfectly free from any insect attacks whatever. No caterpillar of any kind has ever been found feeding on its foliage; no Buprestid or Scolytid beetles bore in its trunk or branches, and no gall-insects disfigure its leaves or twigs. This tree, with its beautiful dense foliage, is, in fact, to be highly recommended as a shade tree in the South, and especially in those cities which are so badly infested with the

Bag-worm *(Thyridopteryx ephemeræformis).* This immunity enjoyed by the China tree from the attacks of insects, is not perfect, however, as we have recently received from Alabama some twigs and leaves infested with the scales of a Coccid belonging to the genus Lecanium; but what is more interesting, the twigs are covered with the waxy scales of a Ceroplastes of really beautiful appearance and new to science. The leaf-cutting ant *(Atta fervens)* shows a decided partiality for the leaves of this tree in Texas.

Galls on Eucalyptus.—Mr. R. McLachlan has recently described two very interesting galls occurring on *Eucalyptus gracilis* in Australia; the one a curious modification of a flower bud and possibly Cecidomyidous, the other occurring on the leaf-stem and looking like a capsule with three or four long arms, and supposed to be Lepidopterous. We know of no Lepidopterous galls that take on any such specialized characters as the last named, figured by Mr. McLachlan, the galls made by this Order of insects being almost invariably mere swellings of a stem, a fact which would indicate that the Lepidopterous larva which Mr. McLachlan found in this Eucalyptus gall might be inquilinous.

North American Anthomyiadæ.—Dr. Hagen publishes in the March number of the *Canadian Entomologist*, a list of the North American species of this family of flies, contained in the Cambridge Museum, and which have been examined by Mr. R. H. Meade of England. In Osten Sacken's Catalogue there are 139 species given, including a number of Mr. Walker's, which seem not to have been yet identified. Mr. Meade makes out 121 species, and Dr. Hagen states that Loew's collection contains 12 not seen by Mr. Meade, so that the whole number of North American species, represented in the Cambridge Museum, is 133, of which 34 seem to be identical with European species. The *Anthomyia angustifrons* Meig., of the First Report of the United States Entomological Commission, which so commonly infests, in the larva state, the egg masses of *Caloptenus spretus*, is referred here as in Osten Sacken's catalogue to the genus *Chortophila* Macq.

Galls and Gall-insects.—We are pleased to see, that after some years of intermission, Mr. H. F. Bassett, of Waterbury, Conn., continues his descriptions of North American Cynipidæ. He describes in the above-named journal, several Californian species, among others *C. q. californica*, which attains the largest size, with perhaps one exception, of any hitherto known North American gall. The flies produced from it are all females, but the gall is interesting to the Coleopterist because it nourishes *Ozognathus cornutus* Lec., a beetle very curious from the fact that the male has a long, erect horn on the base of each mandible, the horns nearly meeting at their incurved tips. Mr. Bassett describes his galls from specimens collected in 1878 and 1880, at Red Wood city, California, upon what he considers, with a question, *Quercus hindsii.* Our first specimens of this gall were received some ten years ago from Sonoma county, the oak not being determined, but we subsequently received specimens from San Mateo, Cal., from Dr. L. D. Morse, who is quite a good botanist, and who determined the oak as *Quercus douglasii.* We exhibited specimens of the gall to Mr. Bassett in 1871, and also presented some to Mr. Albert Müller, of Basle (then of England), who refers to it under our MSS. name of *Quercus-californica* in the Proceedings of the London Entomological Society for 1872, p. 32.

Aside from the various parasites which prey upon the Cynips, we have always found these galls to be infested with the beetle[1] above mentioned. Mr. Müller gives an account of his observations on the habits of this insect, showing that it agrees therein with *Anobium.* We would further remark that the beetle breeds in the dry galls and still continues its work in galls that have been in our cabinet over five years.

ANTHROPOLOGY.[2]

THE PEOPLE OF ALASKA.—A very important document to the ethnologist is the preliminary report of Mr. Ivan Petroff to General Walker, upon the Population and Resources of Alaska, forming executive document No. 40, 46th Congress, 3d Session. The author was sent out by General Walker last year for this special service, for which he is peculiarly fitted by his thorough knowledge of both Russian and English. In the prosecution of his labors he traveled 4500 miles by steamer, 2500 by canoe, 1700 by sailing vessel; a total distance of 8700 miles. Our entire Alaskan country as far north as the Yukon was examined, and tabulated reports are given, village by village, of the inhabitants. The people of the Territory may be divided as follows: 1. The Innuit or Eskimo race, which predominates in numbers and covers the littoral margin of all Alaska, from the British boundary on the Arctic to Norton sound, of the Lower Yukon and Kuskokvim, Bristol bay, the Alaskan peninsula, and Kodiak island, mixing in, also, at Prince William sound. 2. The Indians proper, spread over the vast interior in the north, reaching down to the seaboard at Cook's inlet and the mouth of Copper river, and lining the coast from Mount Saint Elias southward to the boundary, and peopling Alexander Archipelago. 3. Least in numbers but first in importance, the Aleutian race, extending from the Shumagin islands westward to Atto—the *ultima Thule* of this country. The grand total of population is: whites, 392; Creoles, 1683; Aleuts, 2214; Innuits of Kodiak, 2196, of Togiak, 1826, of Bristol bay 2099, of Kuskokvim, 3505, of Yukon, 3359, of Behring sea, 1533, of the

[1] *Anobium cornutum* Lec., Proc. Phila. Acad., 1859, p. 87. Subsequently made the type of a new genus, *Ozognathus*, ibid., 1865, p. 226.

[2] Edited by Prof. OTIS T. MASON, Columbian College, Washington, D. C.

Arctic coast, 2990; Indians 8401—total 30,178. The appearance and habits of the natives are also described, and a map gives the locality of all the places mentioned. The writer is exceedingly happy in his style, and the student will be agreeably disappointed who expects to find in this report a mere mass of arid details.

LANDA'S ALPHABET.—The story of the Abbé Brasseur de Bourbourg and his discovery of the Landa alphabet in the archives of the Royal Academy of Madrid in a manuscript entitled "Relacion de las Cosas de Yucatan," has been told again and again. Nothing daunted by these frequent repetitions, Mr. Philipp Valentini, the learned Mexicologist, advances to the front in a paper published in the April number of the *Am. Antiquarian* for 1880. We had occasion to speak of the judicious treatment of this subject by Professor Rau in his Palenque Tablet volume. Professor Valentini sets out with the assumption that the alphabet is a Spanish fabrication, that the Central American hieroglyphics stood for objects and nothing else, and that the believers in this alphabetic table were laboring under a delusion. The literature of the Conquest, particularly the Mendoza codex, is invoked in confirmation of this view. Coming to Bishop Landa himself, Mr. Valentini first examines his text and rejects it as insufficient; the remainder of the paper is devoted to the alphabet. Its genuineness is questioned on the following grounds: 1. The number of letters does not agree with that of the Maya sounds; 2. The succession is the same as in the English Alphabet, though this is allowed to be not improbable; 3. There are various characters for the letters *a*, *b*, *l*, *o*, *p* and *u*; 4. Attention is called to the fact that though this may be *an* alphabet, it is not *the* Maya alphabet. Indeed, the presumed phonetic key represents nothing else than one of the various attempts made by the Spanish missionaries to teach their Yucatecan pupils how to write the prayers or any other text phonetically by means of symbols. In attempting to substantiate his position, and to interpret the glyphs, however, the author finds himself in the presence of abbreviated and conventionalized symbols without even the Mendoza codex to guide him. Notwithstanding, he plants his foot firmly upon the three following principles previously to making another step: All Central American hieroglyphics are either representations of (1) natural or (2) manufactured objects, or (3) they are symbols—objects conventionally chosen to represent some abstract idea. The twenty-seven letters of Landa are explained as follows: 1. a = *ac*, a turtle; 2. a = *ach*, obsidian knife; 3. a = *a*, the leg (in Quiche), 4. b = *be*, a path or footprint; 5. b, unexplained; 6. c = *tzec*, the fifth Maya month; 7. t = *te*, counting years, the sun; 8. é = *eek*, black; 9. h = *haab*, the year tied up; 10. unexplained; 11. ca = *caa*, to pull out hair; 12. k = *cimich*, death or skull; 13. unexplained; 14. l = *elel*, the pod of the oxalis; 15, 17, 18. unexplained; 16.

n = *ne*, tail; 19. p = *pek*, dog; 20. pp = *ppec*, stone; 21. *cum*, the guacal gourd; 22. ku = *kuk*, to bud like the cactus; 23. x = *chuy*, a bunch, as of bananas; 24. x = *xe*, to vomit; 25. 26. u = *uuc*, to bend, to wind; 27. z = *tzee*, to mash corn.

The Historical Society of Wisconsin.—The 27th Annual Report of this society reminds us of the very great amount of good which can be accomplished with limited means. The report of the operations of the society touches anthropology at several points. There is a committee on Indian history and nomenclature, consisting of Messrs. Chapman, Butler, Conover, Durrie and Hutchison; another on prehistoric antiquities, to which belong, in addition to some of those above mentioned, Messrs. Perkins, Allen and Giles. Another committee is charged with collecting the history of the early settlements. The society is the trustee of the State collections, and holds all its present and future collections and property for the State.

America and the East.—In a paper reproduced in part from Mr. C. N. Holford in the *Kansas City Review* of Feb., is another of the many occurrences of what might be called the "double-corner" of archæology, from the game of checkers. We are in the presence of a vessel or a sculpture from Mexico which reminds one very much of the hoary civilization of Egypt. The interminable game begins between the assumption that similarity of technique demonstrates consanguinity, or at least contact; and that the human mind, being one, unfolds itself similarly under like environments.

Harvard Library Bulletins.—No. 17 of these publications gives a list of the more important accessions to the library during the past year. A goodly number of these are upon anthropology and are accredited to the Peabody Museum of Archæology.

Antiquities of Peru.—A. Asher & Co., of Berlin, are preparing to publish in ten parts, folio, a magnificent work by W. Riess and A. Stübel, entitled "The Necropolis of Ancon in Peru: a series of Illustrations of the Civilization and Industry of the empire of the Incas, being the results of excavations made upon the spot." The edition in English is limited to 250 copies, 100 of which have been taken by Messrs. Dodd, Mead & Co., who have the exclusive sale of the work in America.

Anthropology in France.—The October number of *Revue d'Anthropologie*, closing the third volume of the second series, is one of exceedingly great interest. The opening article by Dr. Pozzi, is an eulogy upon Dr. Paul Broca, the most distinguished French anthropologist, and the founder of the "Ecole d'Anthropologie," and the "Laboratoire d'Anthropologie," of Paris. Accompanying the sketch is a photograph of Dr. Broca, and a complete bibliography of his writings, pages 592–608, extending from 1847 to 1880, and embracing nearly five hundred titles. At the close of the number, pages 722–738, will be found the funeral discourses by M. Eugène Pelletan, in the name of the Senate; M. Verneuil, for the Faculty of Medicine; M. Trélat, for the Academy of Medicine; M. Tillaux, for the Chirurgical Society; M. Dumont-Pallier, for the Biological Society; M. Gariel, for the French Association; M. Ploix, for the Society of Anthropology; and M. Henri Martin, on behalf of the Institute. Dr. Gavarret, formerly President of the Société d'Anthropologie, and at present Inspector-General of the Medical Schools of France and Professor in the Faculty of Medicine, at Paris, succeeds Dr. Broca as President of the School of Anthropology. The unaffected sorrow which has found expression in other anthropological societies and journals, besides those in his own country, is keenly felt on this side of the Atlantic by many who have delighted to sit at the feet of the deceased savant. Dr. Broca (born on the 28th of June, 1824—died, July 8–9, 1880), can scarcely be thought to have reached "the summit of his curve." Cut off in the midst of his arduous labors he has left a void in the heart of his pupils and colleagues which it will be impossible to fill.

Though somewhat overshadowed by the account of Dr. Broca, the remaining matter of the *Revue* is quite up to the standard. The original papers are: Etudes d'Anthropométrie sur les Canons Anthropologiques. I. Du Tronc, by Paul Topinard, pp. 609–620; Les Negres ches eux, ou études ethnographiques sur les Populations de la Côte-d'Or (Côte occidentale d'Afrique), by M. A. T. Mondière, pp. 621–650 (to be continued); Excursion Anthropologique au Sahara (1880), by Dr. H. Weisgerber; pp. 651–668. Dr. Topinard criticises at length M. G. de Rialle's volume in the Bibliothéque Utile entitled, *Les peuples de l'Afrique et de l'Amerique*, published in Paris, 1880, by Balliere et Cie.

The number closes with a résumé of works on prehistory; climography of Algeria; Anthropological Journals of France, Italy, England and Germany; and a list of anthropic papers read at the French Association, p. 738.

SEPULCHRAL MOUNDS AND COSTUME IN JAPAN.—In Vol. VIII, Pt. III, Translations of the Asiatic Society of Japan, pp. 313–332, will be found an important paper by Ernest Satow, upon ancient sepulchral mounds in Kaudzuki province. The author makes honorable mention of Professor Morse's important discoveries in the shell heaps of Omori and then proceeds to describe the burial-mounds. Two forms are mentioned, the circular tumuli, apparently for persons of inferior rank, and the double tumuli, from one of which was obtained a large collection of pottery, iron weapons, articles of bronze and blue glass beads. These twin mounds *Futa-go yama*, lie east and west, the west end being square, the eastern, round, and the middle, contracted. The east end contains the tomb, opening south, and is divided into three sections, the outer passage, the sacrificial chapel, and the vault.

Many of the stones forming the roof are very large. "Each mound seems to have been built up in three tiers, on the top of each of which was a fence formed of a row of terra cotta pipes about two feet high, connected by wooden poles or bamboo passed through holes about half way from the base. The paper is illustrated with forty-three figures, some of which resemble pueblo and central American specimens (Figs. 2–5), and a careful examination of them will well repay those who are engaged in the study of comparative archæology.

Equally interesting and valuable is Mr. Josiah Conder's paper in the same number, pp. 333–368, on the History of Japanese Costume, and we regret the want of space for an abstract.

Ethnography and Philology of America.—As an appendix to H.W. Bates' "Central America, the West Indies and South America," London, 1878, 8vo, the ethnologist A. H. Keane, B. A., has published an article of one hundred and twenty-eight pages, entitled "Ethnography and Philology of America." In the introductory part the author shows considerable judgment and sound reasoning power, but the descriptive portion of the article contains so many defects, that we cannot recommend it without reserve to students of ethnography and linguistics, in spite of all the industrious study which evidently was bestowed on it. The great mistake made by Keane is that of introducing simultaneously a linguistic and a racial (or anthropologic) division of the American natives. What do the Utchees, f. i., have in common with the Cherokees, and these with the Natchez and Catawbas, all of which Keane classed into one group of "*Appalachian Races*"? Does, according to Keane, proximity of the *present* homes of a people prove racial affinity or similarity? The Tutĕlos are classed by him under the Iroquois stock, the Mandans are made a sub-tribe of the Minitari, and the Lower Creeks identified with the Seminoles. An *ethnologic* family of Klamath River Indians never existed in Northern California, and Keane's Lower Californians are simply Yuma Indians. Carr's linguistic division of the Pueblo Indians of New Mexico (p. 479) would be nearly correct, if Nos. 2, 3 and 4 were combined into one stock. For the tribes of the interior of Southern Mexico, of Nicaragua, of Costa Rica, of the Isthmus, of New Granada, not even an attempt of linguistic classification is made, although much material has been published recently on this interesting subject. In the alphabetical catalogue of tribes many typographic errors are noticeable. Besides these, we find the following: Aruaquis are mentioned separate from the Arawaks or "flour-eaters," the Andaicos from the Nandakoes (Tèxas), the Mollale from Mollalas and Molels, congeners of the Cayuses (Oregon). The Goajiros of Venezuela, who speak a language clearly akin to the Carib family, are made Dariens and classified with the Isthmian family. Among the tribes of the Guaicuru family of the Gran Chaco, on the Paraguay river, the important

Mocobi or Mbocobi tribe is not mentioned, but considered as forming, with the Toba and Abiponian dialect, a linguistic family separate from the Guaicuru. In this particular he has copied Balbi; but Balbi is formally contradicted by the Brazilian traveler Martius (*Beiträge* 1, pp. 232, 780), who gives the missionary Dobritzhofer as his authority. The Texan tribe of the Tonkaways is relegated into Florida, and the Piqua regarded as an extinct Algonkin tribe, while it continues to flourish at the present time as a clan of the Shawnees or Shawanoes.

For advancing our knowledge of American ethnology and linguistic topography, not much is to be gained by copying and extracting modern and ancient authors who have not personally seen the tribes of which they give accounts. The number of false and inaccurate statements in this respect is simply enormous, especially regarding Central and South America. Reliable information on all these subjects can only be expected from future expeditions, made by conscientious travelers into the imperfectly explored regions of both American continents.—*Alb. S. Gatschet.*

GEOLOGY AND PALÆONTOLOGY.

Discovery of the Preglacial Outlet of the Basin of Lake Erie into that of Lake Ontario.[1]—This is the subject of a lengthy paper recently read before the American Philosophical Society, of which Dr. Spencer gives the following summary:

1. The Niagara escarpment after skirting the southern shores of Lake Ontario, bends at nearly right angles in the neighborhood of Hamilton, at the western end of the lake; thence the trend is northward to Lake Huron. At the extreme western end of the lake this escarpment (at a height of about 500 feet) encloses a valley gradually narrowing to four miles, at the meredian of the western part of the city of Hamilton, where it suddenly closes to a width of a little more than two miles to form the western end of the Dundas valley (proper). This valley has its two sides nearly parallel and is bounded by vertical escarpments which are capped with a great thickness of Niagara limestone, but having the lower beds of the slopes composed of Medina shales. On its northern side the escarpment extends for six miles to Copetown, but westward of this village it is covered with drift, but it is not absent. On its southern side the steep slopes extend for less than four miles to Ancaster, where they abruptly end in a great deposit of drift, which there fills the valley to near its summit, but which is partly re-excavated by modern streams forming gorges from two to three hundred feet deep. To the north-eastward of Ancaster these gorges are cut down through drift to nearly the present lake-level. Westward of Ancaster, a basin occupying a hundred

[1] *Discovery of the Preglacial Outlet of the Basin of Lake Erie into that of Lake Ontario.* With Notes on the Origin of our Lower Great Lakes. By J. W. Spencer, B.A.Sc., Ph.D., F.G.S., King's College, Windsor, N. S.

square miles, where the drift is found to a great depth, forms the western extension of the Dundas valley. With the north-western and western portions of this drift-filled area, the upper portions of the Grand river and Neith's creek were formerly connected. The Grand river from Brantford to Seneca runs near the southern boundary of this basin, then it enters the old valley which extends from Seneca to Cayuga, with a breadth of two miles, and a depth in modern times of seventy-five feet, having its bed but a few feet above Lake Erie. However, along the eastern margin of this valley, near Cayuga, we find that the rock is absent even to a depth below the surface of Lake Erie.

2. The Dundas valley and the country westward forms a portion of a great *river valley*, filled with drift. Along and near its present southern margin this drift has been penetrated to 227 feet below the surface of Lake Ontario, thus producing a *cañon* with a lateral depth of 743 feet, but with a computed depth in the middle of its course of about 1000 feet.

3. The Grand river, at four miles south of Galt, has, since the Ice age, left its ancient bed, which formerly connected with the Dundas valley, as did also Neith's creek, at Paris.

4. Lake Erie emptied by a buried channel, a few miles westward of the present mouth of the Grand river, and flowed for half a dozen miles near Cayuga, where it entered the present valley, and continued in its channel (reversed) to a place at a short distance westward of Seneca, whence it turned into the basin referred to above, receiving the upper waters of the Grand river and Neith's creek as tributaries, and then emptied into Lake Ontario by the Dundas valley. This channel was also deep enough to drain Lake Huron.

5. Throughout nearly the whole length of Lake Ontario, and at no great distance from its southern shore, there is a submerged escarpment (of the Hudson river formation), which in magnitude is comparable with the Niagara escarpment itself, now skirting the lake shore. It was along the foot of this escarpment that the river from the Dundas valley flowed (giving it its present form) to eastward of or near to Oswego, receiving many streams along its course.

6. The western portion of the Lake Erie basin, the south-western counties of Ontario, and the southern portion of the basin of Lake Huron formed one Preglacial plane, which is now covered with drift or water (or with both) to a depth varying from 50 to 100 feet, except in channels where the filling by drift is very great. A deep channel draining Lake Huron extended through this region, leaving the present lake near the Au Sable river, and entering the Erie basin, between Port Stanley and Vienna, at a known depth near its margin, of 200 feet, but at a probable depth in the center sufficiently great to drain Lake Huron.

7. The Preglacial valleys (now buried) of Ohio and Pennsylvania—for example, the Cuyahoga, Mahoning (reversed), and Allegheny (deflected)—formed tributaries to the great river flowing through the Erie basin and the Dundas valley.

8. The bays and inlets north of Lake Huron are true fiords in character, and are of aqueous origin.

9. The Great lakes owe their existence to sub-aërial and fluviatile agencies, being old valleys of erosion of great age, but with their outlets closed by drift. Glaciers did not excavate the lakes and had no important action in bringing about the present topography of the basins.

10. The old outlet of the Niagara river, by the valley of St. David's, was probably an interglacial channel.

The Iron Ores of Southern Utah.—During the past summer, which I spent chiefly in Utah, I visited the deposit of crystalline iron ore of Iron county, in the southern part of the Territory. These ore beds have been long known and were to some extent utilized by the Mormons in their first advent, thirty years ago, but no satisfactory description of them has ever been published. As they constitute, perhaps, the most remarkable deposit of iron ore yet discovered on this continent, I have thought that some facts in regard to them might not be an unimportant addition to what is known of the economic resources of our country. The iron region referred to lies nearly three hundred miles directly south from Salt Lake city, and is situated in what is really the southern prolongation of the Wasatch mountains. The iron ores occur in the northern portion of a subordinate range, which attains its greatest height in Pine Valley mountain near Silver Reef. Thirty miles north of this point the ridge breaks down into a series of hills from one thousand to two thousand feet in height, which consist chiefly of gray fine-grained granite, with dykes and masses of trachyte and here and there outcrops of highly metamorphosed limestone. The ore beds form a series of protruding crests and masses set over an area about fifteen miles long in a north-east and south-west direction, and having a width of three to five miles. Within this belt the iron outcrops are very numerous and striking; perhaps one hundred distinct claims having already been located upon them, each one of which would make the fortune of a mining company if situated anywhere in the Mississippi valley or the Eastern States. The most impressive outcrops are in the vicinity of Iron springs, Oak springs and Iron city, of which localities the first and last mentioned are about twelve miles apart. Near Iron springs the *Big Blow-out,* as it is called, is a projecting mass of magnetic ore, which shows a length of perhaps a thousand feet by a width of five hundred, and rises in castellated crags one hundred feet or more above its base.

At Iron springs a still more striking exhibition is made by the Blair mine, which is a ragged crest of magnetite, black as jet, formed by the upturned edge of the thickest of a series of sheets of ore, which rises like a ledge of bedded rock two or three hundred feet above the adjacent low lands. This outcrop is visible as a conspicuous black hill, at a distance of several miles. The connections between the ore bodies of this great iron belt are obscured by the *débris* from the easily decomposed trachyte and granite. It is evident, however, that for some miles the iron ore deposits are continuous or separated by very short intervals, as the outcrops occur within a stone's throw of each other, and the surface is everywhere strewed with blocks of rich magnetic ore, enough in themselves to supply all the furnaces of the country for years. It would seem that the iron forms a number of distinct and closely approximated belts, which are the outcrops of beds that stand nearly vertical, and go down into the earth like huge walls.

There is considerable diversity in the character of the ore, though it is about equally divided in quantity between hematite and magnetite. Some of the beds of both are exceedingly dense and compact, while others, though rich in iron, are soft and can be mined with the pick. Most of the ore is apparently very pure, containing a small amount of earthy matter and no foreign minerals. Some of the ledges, however, contain a large quantity of silica, the magnetite being mottled with white quartz; and one of the largest outcrops, though showing many millions of tons of ore apparently quite pure, is thickly set along certain zones, evidently strata of deposition, with crystals of apatite from a quarter to half an inch in diameter and two or three inches in length. At this location many of the fragments are highly magnetic, and lodestone as strong as any known can be obtained there in great abundance. A few rods from this great outcrop is another of equal dimensions, in which the magnetite is apparently quite free from all impurities, showing neither quartz nor apatite. Near by is another exposure, perhaps a continuation of the last, of which the mass is half magnetite and the other half fine-grained and dense hematite. Across a narrow valley from this group the hillside is covered with fallen fragments of a rich but soft and dark hematite, and at no great distance the soil is colored blood-red by the decomposition of a hematite so soft as to make no other show above the surface. Near this latter location I noticed a line of outcrop of a very jaspery hematite, in some places only a ferruginous jasper closely resembling some of the more silicious ores of the Marquette district.

As to the age of this remarkable series of iron ore deposits, I cannot speak with absolute certainty, though they are apparently Lower Silurian.

The granite of the hills which contain the iron is finer grained and less compact than that which forms the great granitic axis of the Wasatch, and I suspect is the metamorphic condition of the quartzite beds which rest upon the Wasatch granite. Some of the iron ore beds in this granite are distinctly interstratified with it, and are certainly, like it, metamorphosed sediments. This is plainly shown at the Blair mine, where the principal crest of the hill is a distinct sheet of stratified, regularly bedded magnetite, from thirty to forty feet in thickness, dipping toward the north at an angle of about eighty degrees. Parallel with this principal layer are other sheets of magnetite separated by strata of granite and varying from a quarter of an inch to ten feet in thickness, as perfectly parallel and regular as any series of sedimentary beds ever seen.

On the whole, the Blair mine is the most interesting and instructive outcrop of iron known to me, and furnishes the most striking proof of the sedimentary origin of these wonderful ore beds. None of the other outcrops are so distinctly stratified, but the Big Blow-out at Iron city affords an equally conclusive argument against the eruptive theory; for while it appears to be a huge amorphous mass, like a hill of basalt, on examination it is found to be in large part composed of metamorphosed limonite; that is, magnetite, which has the botryoidal and concretionary aspect and radiated structure of limonite, and was plainly deposited from water.

With the exception of the great iron deposits of Southern Utah, the far West is but imperfectly supplied with this metal. I have found magnetite and specular ores in small quantities in several places in the mountains of Oregon and California, and in the Rocky Mountain belt, and similar ores have been met with by prospectors and explorers in some of the districts which I have not visited. We have no evidence, however, that any other great deposits of iron exist in or beyond the Rocky mountains. If it is true, which I do not believe, that there are anywhere iron ores that are truly eruptive in character, it is somewhat surprising that in the immense area where igneous rocks predominate in the far West, no masses of eruptive iron ore have been met with. We have reports of eruptive masses of magnetite at Nijni Tagilsk, in Russia, and of hematite on the island of Elba, but no observations have lately been made for the purpose of determining whether these are what they have been reported to be. The famous beds of magnetic and specular ore of Sweden have also been considered, up to a recent date, as eruptive, but Professor Otto Torrell, Director of the Geological Survey of Sweden, with whom I was associated in the Centennial Exhibition, assured me that all the deposits of iron which he had visited in Sweden were metamorphic and not eruptive, and that he had no faith in erupted ores of iron.—*J. S. Newberry, in School of Mines Quarterly, Nov., 1880.*

Geological News.—A paper on the uniclinal structure of the Iberian peninsula, by J. Macpherson, is published in Spanish and English. A section of the rocks from the Mediterranean to the Cantabrian coast is given.——Mr. Eugene Smith, State Geologist of Alabama, gives an account of the geology of Florida, in the April number of the *American Journal of Science and Arts.* He shows that the Vicksburg limestone occupies the center of the State, and that a small patch of earlier Miocene in the eastern center of the State, is the oldest formation within its limits. The everglades and coast regions are Post-pliocene.——In the same journal Professor Marsh describes a new genus of Opisthocœlous saurians, which he calls *Cœlurus.* The vertebræ resemble those of *Camarasaurus*, but the walls are more attenuated, and the caudal centra are hollow. It is probable that *Amphicœlias fragillissimus* Cope, belongs to it. Professor Marsh proposes to regard the genus as the type of a new order, but gives no reasons for so doing.——The second annual report of the Bureau of Statistics and Geology of Indiana for 1880, under the direction of John Collett, is published. It includes reports on the Geological Survey of two counties, Monroe and Putnam; descriptions of new fossil Invertebrata, by R. P. Whitfield, and a synopsis of the recent Mollusca, by Frederick Stein, M.D.——Calvert and Neumayr publish in the Denkschriften of the Wiener Akademie, an article on the Tertiary formations of the Hellespont. They refer the latter to two divisions which are unconformable to each other, of which the inferior is upper Miocene. Fossil remains of *Vertebrata* and *Mollusca* are abundant and are described by the authors.——A deposit of carbonate of lead and silver carrying chloride of silver and embolite, forming the surface of a considerable hill, has recently been found in Southwestern New Mexico, by George Daly. It resembles the formation at the Silver King mine of Arizona, but is more extensive.——Mr. S. A. Miller, in the Journal of the Cincinnati Society of Natural History, continues his history of American geological work. His last article (April, 1881) covers the later writings on the Tertiary periods, but does not conclude this part of the subject. It covers forty-three pages, octavo, and includes much information of importance to geologists, in a condensed and conveniently accessible form. Lists of the fossil species are given.——In the same periodical, Professor A. G. Weatherby describes a number of new species of *Crustacea*, *Cephalopoda* and *Crinoidea* from the Silurian and Subcarboniferous rocks of Ohio and Kentucky. They consist of species of *Isochilina*, *Proetus*, *Cyrtoceras*, *Colpoceras*, *Trematodiscus*, *Reteocrinus* and *Heterocrinus.*——In the Proceedings of the Philadelphia Academy, Professor Heilprin discusses the fossils and age of the Lower Eocene formation of Clarke county, Alabama.

GEOGRAPHY AND TRAVELS.[1]

SIBERIA IN EUROPE.—Mr. Henry Seebohm, to whom we are already idebted for much valuable information concerning Siberia,

[1] Edited by ELLIS H. YARNALL, Philadelphia.

has now prepared a full account[1] of his journey to the valley of the Petchora, which was made previous to a longer journey through Asiatic Siberia as far as the Yenesei. The portion of the Russian dominions described in this volume occupies the north-eastern corner of Europe, and lying within the Arctic circle, is a dreary, monotonous land, with nothing to tempt the ordinary traveler. Its great morasses are always frozen at a foot below the surface and much of the firmer land, when not under the snow, is covered by water from the flooded streams.

Mr. Seebohm's and his companion, Mr. Harvie-Brown's object in visiting the Petchora, was principally to complete their studies of ornithology of Northern Europe, and whilst entirely successful in this respect, they have also collected much valuable information for the geographer regarding this remote region. Mr. Seebohm having previously visited Norway, with a similar purpose, on his return compared the results of his investigations with those made about the same time by Mr. Harvie-Brown in the valley of the Dwina near Archangel. The difference between the birds in these two countries was very striking, and it was concluded that by pushing their explorations ten degrees further eastward, they would find the breeding ground of birds whose nests had never been seen, though known as migrants in southern and western Europe.

The species which excited the keenest interest were the gray plover *(Squatarola helvetica)*, the little stint *(Tringa minuta)*, the sanderling *(Calidris arenaria)*, the curlew sandpiper *(Tringa subarquata)*, the knot *(T. canutus)*, and Bewick's swan; but many other rare birds might also be reasonably expected to breed in the same district.

The travelers set out from London, in March, so as to reach the Petchora before the melting snows and the resulting floods made further progress impossible. Passing through St. Petersburg and Moscow, they reached the end of the railroad at Vologda and continued their journey by a sledge ride of six hundred miles to Archangel. From here to Ust-Zylma, on the Petchora, is a distance of over seven hundred miles. "A fortnight after arriving at Ust-Zylma," says Mr. Seebohm, "the snow became impassable, the winter road was broken up, the horses at the stations in the uninhabited portions of the country, a distance of two hundred and fifty versts, were sent home, and for two months the valley of the Petchora was as completely cut off from all communication with civilized Europe, as if it had been in the moon." One hundred and fifty miles of impassable swamp barred all communications. Ust-Zylma is a large, straggling village, most of whose inhabitants belong to a sect known as "Old Believers." Outside

[1] Siberia in Europe; a Visit to the Valley of the Petchora, in North-east Russia; with descriptions of the Natural History, Migration of Birds, etc. With Map and Illustrations. By Henry Seebohm, F.L.S., London, 1881.

the village were several camps of Samoyedes, of whose life and customs much is told.

On the opening of navigation the travelers embarked on a small steamer and descended the Petchora to its delta, east of which was the *tundra*, "a wide expanse of moorland covered with lichen, reindeer moss, dwarf shrubs and birch, with swampy patches and morass into which it was impossible to sink more than a foot deep, owing to the frozen pavement below." Their exertions here received their reward in the valuable collections of birds and eggs obtained. On the first of August they broke up their camp on the tundra, and embarking on a steamer, passed around the North Cape, and after a voyage of thirty-five days, reached Elsinore.

The collections brought back include eggs of the gray plover and the little stint. Excellent wood cuts, illustrating the country and its natural history, are given and a very satisfactory summary of the scientific results of the journey is added.

COLONEL PREJEVALSKY.—The Royal Geographical Society's *Proceedings* states that, having reached home, this eminent traveler intends "to devote himself for some time to the preparation in retirement of a great work on the results of his travels, including besides his recent expedition to Tibet, his previous journey to Lob-nor, of which he was prevented, by want of time, from giving more than a bare outline. The work is to consist of eight volumes, and to be entitled "Travels in the Deserts of Central Asia." Volumes I and II will contain the narrative and an account of the physical geography and ethnography of the countries he has visited, and will include also his surveys, the pictorial illustrations being from original sketches by his companion, Lieut. Robarofsky. Volume III will be devoted to the mammalia of Central Asia; Volume IV to the birds; Volume V to the reptiles, amphibia and fishes; Volume VI to the flora of Mongolia; and Volume VII to that of Tibet. Volume VIII and last will contain the geology and mineralogy as far as materials will permit. The first two volumes, each containing five hundred pages and perhaps more, will be written by the traveler himself, and will appear towards the close of 1882. The ornithology will also proceed from his pen, as well as that portion of the zoölogy which treats of the antelope, buffalo, and a few other of the more important animals. The remainder will be written by the academicians Strauch and Maximovitch, Professors Kepler, Inostrantsef, and Bogdanof, and will be issued in parts. The whole will not be completed for several years. The work will be brought out under the auspices of the Russian Geographical Society and a special grant for the purpose will be asked for from the Emperor."

M. DE BRAZZA'S JOURNEY FROM THE OGOWE TO THE CONGO.—One of the most remarkable of recent journeys in Africa is that of M. de Brazza. We noticed his starting from his station near

Mashogo, on July 14, 1880,[1] for the Congo. No details of his journey have been received, but he succeeded in reaching the Congo at Ntamo-Nkouma, about one hundred miles south of the equator or between 2° and 3° south latitude and between the river Mpaka-Mpama and the Lawson(?). Gaining the favor of King Makoko, he was able peacefully to descend the Alima to its junction with the Congo. On October 3d, he founded the station Ntamo-Nkouma, on land ceded by the king, on the right bank of the Congo. Makoko is King of Ubanji (Ubangi-Stanley). The distance by this route from the Ogowé to the Congo is twelve marches, over a plateau of an average height of eight hundred metres. The country is healthy and the population dense and peaceful. He left a sergeant and three men at Ntamo-Nkouma,who can be supplied and revictualled from Ogowé station by an easy route.

Descending the Congo in boats in November, he arrived at Mdambi-Mbongo, about long. 14° east, the advanced post of Mr. Stanley, whom he met and with whom he reached the latter's headquarters at Vivi, on November 12th. He reached the Gaboon, on December 16th. In two days he started again for the Ogowé and the basin of the Congo. His first station, Mashogo, is in the country of the Okandi. This tribe is devoted to agriculture, and food is plentiful in their country. M. de Brazza has now taken with him, in sections, a small steam vessel, which has been lately built of steel expressly for his explorations, and after reaching the upper course of the Ogowé he hopes to be able to get it conveyed to the Alima or one of the other affluents of the Congo.

M. de Brazza is the first European traveler, who has penetrated into the interior of equatorial Africa from the west coast. He believes the Ogowé to be the best means of communicating with the interior, as the Congo is so interrupted by cataracts and rapids.

Stanley on the Congo.—The permanent station on the Congo of the Stanley expedition is on an elevated plateau below the Yellala falls. It is now a small town containing the dwellings of Mr. Stanley and his European staff, workshops, warehouses, and huts for his laborers and a garden producing vegetables of almost every description. From the river's edge to a distance of about thirty miles upwards along the hilly banks of the Congo, where he has established his second depot, a road about twelve feet wide has been constructed, serviceable for carts and wagons, which latter together with twenty donkeys have recently arrived from Europe, to be employed in the transport of stores and supplies. In addition to the Zanzibar people brought round to the Congo by Mr. Stanley, he has obtained the services of a large number of natives, from the lower Congo, and has with him in the in-

[1] See Naturalist, February, p. 167.

terior about one hundred and twenty-five; while at Vivi, which is under the charge of his agent, Mr. Sparhawk, the laborers are all from Kabenda, under agreement to serve for a fixed period, it having been found that the tribes in that part of the country are not to be relied upon for regular work.

The trade on the Lower Congo is very large and increasing. The highest point where traders are established is at Noki, twelve miles below Vivi, which can be reached by vessels drawing eighteen feet of water at any season without the least difficulty. Above Noki no vessels have been, but there seems little to prevent their ascending as far as Vivi.

The above statement of Mr. Stanley's progress in given on the authority of the R. G. S. *Proceedings*, but other accounts obtained from visitors to Vivi speak of Mr. Stanley's road as a gigantic undertaking of very great cost, which will not be completed for several years yet, and indeed it is thought doubtful if it will ever be practicable for wheeled vehicles.

Meanwhile a missionary party under Mr. A. McCall is working its way to the Upper Congo by the north bank of the river, having erected a permanent station at Mataddi Minkanda, opposite Vivi. At last accounts they had arrived within three days' march of Manyanga (about E. long. 15° S. lat. 15°). Mr. McCall hopes to be able to reach Stanley Pool this coming autumn.

African Exploration.—Dr. Buchner, the German traveler in West Central Africa, spent the first six months of 1880, in Mussumba, the capital of the Muata Yanvo, making many interesting investigations into the topography and natural history of the country. The Muata Yanvo refused to allow him to proceed northward from his dominions, so departing from there on the 1st of July, he crossed the Lulua, sent back most of his people and his collections to Angola, and started for the north with fifty men. His astronomical observations necessitate great alterations in the measurements made by Schütt.——Herr Gerhard Rohlfs, having been sent by the German Emperor with presents and letters to the ruler of Abyssinia, has left Massaua, accompanied by Dr. Stecker, and reached the plateau of Abyssinia by very steep, difficult paths. Starting from Ailet, up to which place they had traveled under an Egyptian escort, they accomplished the ascent to Kasen, situated more than eight thousand feet above the level of the sea, without loss of baggage or animals. All along the track the country presented the most savage, but, at the same time, the most picturesque aspect. The valleys and mountain slopes were everywhere covered with a most magnificent tropical vegetation, consisting of gigantic sycamores, wild citron trees, mimosa, etc., densely intertwined with luxuriant creepers; and as day after day the travelers climbed the summits of mountain ranges or descended into deep valleys, the flora and the abundantly represented fauna of the country exhibited the utmost variety. Dr.

Stecker has sent home a detailed description of the country surrounding Massaua, together with meteorological observations, which will shortly be published.——An expedition sent out by the French government from Senegal to the Niger, has reached Segou-Sikorro, on the Niger, and found the Sultan well disposed and willing to allow the French to navigate and trade on the Niger. Captain Gallieni, commanding the expedition, finds that near Bamaku, the water shed of the Niger and Senegal basins, is only a few miles from the former river and the water parting is so indistinctly marked, that during the rainy season the water flows sometimes into one river and sometimes into the other.——Recent explorations by French travelers show that the western Sahara has considerable tracts of lands that can be reclaimed and fertilized by boring artesian wells, and where this has been done luxuriant gardens planted with date, fig, and other fruit trees, and fields of barley have taken the place of stunted shrubs or bare, sandy soil. The land of Adrar in the south-west is placed like a long narrow island between two bands of sand and contains a considerable population. Yet while the skill of the French engineers would no doubt overcome the natural difficulties in the way of the railroad projected through this region of sand hills, it is not easy to understand how a paying traffic could be secured or how the road could be protected from the hostility of the natives.——Great activity continues to exist on the east coast of the African continent, where many expeditions continue to enter, chiefly from Zanzibar. The strictly scientific exploring parties are outnumbered by the missionary companies, but none of them have added much of late to our knowledge of this portion of Africa, their letters relating simply their advances from station to station, and often containing sad stories of misfortune, starvation, or death. At the same time permanent stations have been established in the interior and on Lake Taganyika, and more successful results may reasonably be expected in the future.

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MICROSCOPY.[1]

Examination of Metalliferous Clays.—Mr. Melville Atwood, in a paper on the clays in the Comstock lode, read before the San Francisco Microscopical Society, describes as follows the method of separating and examining the gold-bearing fragments.

"The way in which I made the examination of the clays was, first, to place them in a porcelain dish, pouring hot water over and keeping them in the water for several hours, stirring occasionally, till all the particles that would dissolve were taken up by the water. Afterward I emptied the contents of the porcelain dish into a batéa, allowing everything that was dissolved to float away. By the batéa the pyritic matter and other heavy bodies

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

were separated from the rest of the coarser, rounded and lighter fragments of vein-stuff and country rock. The pyritic matter is then tested for gold, silver and tellurium, and also a microscopic examination of it is made under water. The fragments of country rock and vein-stuff are then washed again, using a brush to rid them of any clay that might still adhere to them. After drying, they are put into a separator having sieves with 30, 50 and 100 holes to the linear inch—a uniform size enabling me to examine them better with the microscope. The fragments that pass through the sieve having 100 holes, I place in a small cell, fastened on the glass slide, and filled with water, which I cover with thin glass—the shape of the fragments are seen much better in this way, since by slightly moving the thin glass cover, they can be made to turn and exhibit their forms in different directions.

Arranging Small Objects on Slides.—Mr. Julien Deby proposes to facilitate the arrangement of diatoms, foraminifera and other small objects on slides for mounting, by drawing on the plain mirror of the microscope regular lines in crosses, circles, or any desired patterns. The achromatic condenser being so focussed that the image of these lines shall be in focus of the objective at the same time with the object slide, there is no difficulty in similarly arranging the objects by hand or by means of a mechanical finger.

The Hartnack Microscopes.—It is now eleven years since Hartnack was—in common with other Prussians during the Franco-Prussian war—compelled to leave France. He immediately settled in Potsdam, and there established an optical factory for microscopical work. M. Prazmowski, who had been for several years working with Hartnack, was admitted into partnership, and took entire charge of the house in Paris. The exhibit of microscopes, &c., at the Paris Exhibition of 1878, was by the firm Hartnack & Prazmowski. Since that date the partnership has been dissolved; the Potsdam house remaining exclusively Hartnack's, and the Paris house Prazmowski's. It is well known in Paris that to M. Prazmwoski's mathematical attainments have been due the improvements developed by the house during the past fifteen years or more.—*F. R. M. S. in Eng. Mechanic and World of Science.*

New Sea-side Laboratory.—Professor A. Hyatt, the curator of the Boston Society of Natural History, announces that a seaside laboratory will be opened, this year, under his direction, at Annisquam, Mass., three miles from Gloucester, from June 5th to September 15th. The laboratory, which is designed rather for teachers or students of some experience than for beginners in Natural History, will be under the immediate care of Mr. B. H. Van Vleck, assistant in the Museum and Laboratory of the Boston Society of Natural History. Students are advised to bring their own microscopes. Only a limited number of students can be accommodated; and applicants should state the amount of their previous experience in such work.

MICROSCOPIC OBJECTS.—Mr. M. A. Booth, of Longmeadow, Mass., is furnishing unmounted objects, by mail, at the price of one dollar for twenty-five packets. Printed lists of the objects offered can be obtained from him.

Mr. Geo. W. Morehouse, of Wayland, N. Y., has issued a list of mounted objects, chiefly animal substances and preparations of various kinds, which he is offering for sale at thirty cents each, or four for one dollar.

Mr. David Folsom, of Chicopee, Mass., has also undertaken to prepare objects for sale, or mount them to order.

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SCIENTIFIC NEWS.

— At the last meeting of the State Natural History Society of Illinois, Professor J. G. Forbes said that the time for argument in scientific societies respecting the truth of the doctrine of evolution had passed, as scientific men were substantially agreed that it was either strictly true or a close approximation to the truth. He traced the rapid progress of the doctrine in this country, accounting for this by the fact that naturalists found its principles continually verified by new discoveries springing up all over the earth. This point was illustrated by some of his own observations on the development and anatomy of certain fishes, of which he had made a special study.

Passing to the application of the development theory, the speaker took up, as an instance of its practical uses, the subject of the restocking of our waters with their native species of fish. He criticized the idea put forward by prominent fish-culturists, that fishes could be artificially multiplied to such a degree that it would make no difference how or when or in what numbers, they were captured, showing that this idea involved a contradiction of the doctrine of natural selection. The conclusion was reached that the protection of fishes was fully as important as their artificial multiplication. He showed that the food supplies of fishes were diminished by the drainage of swamps, restriction of overflows by levees, and other operations attendant upon the settlement of a country; and that it was therefore not to be expected that the fishes of a body of water could be permanently kept up to as high a number as occurred there naturally in a state of primeval nature.

— The fourth session of the Marine Laboratory maintained by the Johns Hopkins University in connection with its biological department, will commence at Beaufort, N. C., May 2, 1881. The session will continue until the end of August. Dr. W. K. Brooks, Associate in Biology and Assistant Professor of Comparative Anatomy, will be in immediate charge as director.

The Laboratory is provided with a steam launch; small boats, nets, dredges, aquaria, microscopes, reagents, and a small reference library are also supplied by the University, for their use. Those admitted to the Laboratory will be charged a fee of $25.

The Marine Laboratory is designed for advanced students and for those qualified to carry on original investigation. No definite courses of instruction will be given, as the persons received will be presumed to have sufficient knowledge to carry on their studies without such aid. Dr. Brooks will, however, exercise a general supervision, and control and direct the daily work of the Laboratory. Board and lodging may be obtained in the town of Beaufort near the Laboratory, for from $20 to $30 per month.

— That germs of disease may live long, seems to be proved by recent experiments of a French Committee directed by M. Pasteur. Seven sheep were led daily, for a few hours, to a piece of ground where some animals that died of anthracoid disease, or *charbon*, had been buried *twelve years previously*. Two of them caught the disease and died. There was no grass for the sheep to eat, and it is thought those two must have received the germs in the course of smelling about the ground, as sheep generally do. It may be added that on some ground of that farm, where diseased animals had been buried, vegetables are now grown; and M. Pasteur asked the farmer if any employés, etc., about the farm have been affected. He knew of none, but showed a healed sore of malignant pustule (the same kind of disease) on his own face. M. Pasteur supposes that if the vegetables eaten had not been cooked, there might have been a different tale. The disease, too, might be communicated by the agency of insects, etc.—*English Mechanic.*

— Pasteur has found on taking fowl cholera poison from a a fowl which has died, not of acute but of chronic disease, and cultivating this in several solutions of fowl-broth, that on transferring it in succession from one to the other, it suffers no diminution of its virulence in the passage. However, experiments made by varying the length of the periods of time during which the solutions are left intact, after having the parasite added to them, show that the time allowed for its development is an important element in the question. Thus, with intervals of only from one day to two months between any two successive inoculations of the solutions, no modifications of their virulence is experienced; though in proportion as the interval is increased, signs of such a modification appear in the slowness with which death occurs, and in the diminished acuteness of the preliminary symptoms.

— The Kansas Academy of Science, at their November meeting, appointed a Commission to memorialize the Legislature in reference to a State Survey. Two preliminary surveys under Professors Mudge and Swallow have already been made. A more extended and thorough scientific survey is now needed. The most active geologist now in the field in this State is Professor O. W. John, who for two years past has studied the stratigraphical geology of eastern Kansas.

— Last summer Professor F. H. Snow, with several assistants, spent over a month in Santa Fé Cañon, New Mexico, as well as in Colorado, and made important entomological collections, among them were twelve new species of Coleoptera, and an interesting collection of geometrid moths, comprising a number new to the Colorado plateau region.

— The French zoölogical station at Roscoff has been making good progress of late. It has now an aquarium of one hundred square meters extent, and a good steamer for excursions; and is soon to be provided with a pond and a diving dress. M. Lacaze-Duthiers, who founded this station, announces the establishment of a second one at Port Vendres.

— The death is announced of Dr. John Jeremiah Bigsby, F.R.S., a well-known writer on palæozoic fossils, at the advanced age of 88 years. The greater part of his life was spent in Canada and in the United States, and his writings on American geology date back to 1820, when he contributed a paper to *Silliman's Journal.* Dr. Bigsby's best-known works are his "Thesaurus Siluricus," which appeared in 1868, and his "Thesaurus Devonica-Carboniferus," published ten years later. The "Bigsby Medal," which he presented to the Geological Society of London a few years ago, was awarded at the anniversary meeting on Friday, the 18th inst., to the French geologist, M. Charles Barrois.

— Professor Tennant, for many years professor of geology in King's College, London, died early in March, aged 72. Gabriel Koch, a well-known lepidopterist of Frankfort-on-the-Main, died in February, aged 80; also Professor Gorini, of Lodi, known by his works on volcanic phenomena.

— Edward R. Alston died at the age of 35 years, was born in Lanarkshire, Scotland. He was an excellent zoölogist. His most important paper is a monograph of the classification of the order of *Rodentia*, published by the London Zoölogical Society in 1876.

— George B. Emerson, LL.D., well known for his love of nature, and as the author of a "Report on the Trees and Shrubs growing naturally in the Forests of Massachusetts" (1846), which lately passed through a second enlarged and illustrated edition, died in Boston, in March. He was born in Kennebunk, Me., Sept. 12, 1797. He taught in Boston many years, wrote on educational topics, was President of the Boston Society of Natural History, and a liberal patron and friend of Science.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Philosophical Society, Philadelphia, Oct. 15, 1880.—A letter from Dr. Henry Draper announcing the successful photographing, in fifty minutes, of the Orion nebula, was read; and Dr. Barker made some remarks in regard to the discovery. Mr. Lesley described a kitchen-trash heap at Saltzburg, Va.

Nov. 5.—Dr. Horn presented two papers for publication in the Proceedings, entitled, "Critical notes on the species of Selenophorus of the United States," and "A review of the species of Anisodactylus inhabiting the United States." Mr. Lesley exhibited some recently executed works of the State Geological Survey.

Nov. 19.—Mr. Lesley exhibited and described three models in plaster, 1st. Of the seven mountains in Middle Pennsylvania, surveyed by Chas. E. Billin; 2d. Of the Stone mountain fault, by the same, and 3d. Of a part of the Middle Anthracite Coal field, constructed from the first specimen sheet map of the Anthracite Survey, by Mr. Chas. A. Ashburner.

Dec. 3.—A communication entitled, "On the Vertebrata of the Wind River Eocene bed, of Wyoming, by E. D. Cope," was read by title. Dr. König remarked on two specimens of silver ore from near Ouray, in Colorado.

Dec. 17.—Prof. Cope remarked on the fossils of the Wind River Eocene beds.

Jan. 7, 1881.—A paper on Photodynamics was read by Professor Chase. A note on the protection of oil tanks from lightning stroke, by B. Howard Rand, and extracts from letters on the discovery of Permian shells in the Upper Coal measures at Wilkesbarre, by Dr. Ingham, were read. A MS. map of the geology of parts of Lee, Wise and Scott counties, Va., by J. J. Stevenson, was presented by Mr. Lesley. Mr. Lesley exhibited a map of Pennsylvania, showing the progress of the survey since 1874.

Feb. 4.—Professor J. J. Stevenson communicated a paper entitled, "The Upper Freeport Coal bed along Laurel ridge, in Preston county of West Virginia."

Feb. 18.—A communication was read, entitled "Certain almanacs published in Philadelphia between 1705 and 1744, by Henry Phillips, Jr."

March 4.—Mr. Lesley read a paper entitled, "Notes on the meaning of the word *Hebrews*, and on Egyptian names of Hebrew kings."

March 18.—A paper "On the Preglacial drainage of the Great lakes, by Dr. J. W. Spencer," was read by the secretary. "A geological section at St. Mary's in Elk county, Pa.," was explained, and the importance of its consequences noted, by Mr. C. A. Ashburner.

Philadelphia Academy of Natural Sciences, Nov. 9, 1880.—Rev. Dr. McCook spoke on the habits of Basilica spiders and their mode of constructing the dome shaped webs and the cocoon.

He asked for information regarding the use, by birds, of the spinning work of spiders in the construction of their nests. Dr. Kōnig spoke on Beegarite.

Nov. 16.—Mr. Meehan remarked on the sexual organs of Andromeda. Mr. Potts gave the names of the new species of fresh-water sponges collected in Fairmount Park, and spoke on the characters of some other forms observed by him.

Nov. 23.—Dr. McCook spoke on the enemies of spiders.

Nov. 30.—Mr. Ryder gave an account of the development of *Mya arenaria.* Mr. Meehan spoke on the germination of seeds. Dr. Parker remarked on the morphology of the occipital lobes of the brain. Dr. Dercum spoke on the termination of nerve-fibers.

Dec. 7.—Dr. McCook spoke on the protective instincts and industries of the spiders. Mr. Potts remarked on the feeding habits of ants.

Dec. 14.—Professor Allen spoke on the phalanges of the bat's wing. Mr. Ryder described *Zygonopus whitei*, a new myriapod from a cave in Virginia.

Jan. 4, 1881.—Dr. Leidy spoke on the use of rhizopods as food for fishes.

Jan. 25.—Dr. Horn spoke on the mouth organs of the Carabidæ and their value in classification.

Feb. 1.—Mr. Ryder remarked on Protozoa of Europe and the United States.

Feb. 8.—Mr. Meehan remarked on the lack of trees on prairies. Mr. Bassett spoke on Hymenoptera producing galls.

Feb. 22.—Dr. McCook remarked on analysis of honey and development of abdomen of ants. Dr. Kite spoke on the skulls of hornbills.

March 1.—Mr. Potts made observations on Spongilla. Professor Heilprin spoke on geological classification.

Boston Society of Natural History, March 16.—Dr. W. G. Farlon made some observations on the plants of Bermuda, and Professor N. S. Shaler discussed the advance and recession of glaciers.

American Geographical Society, March 25.—Lieut.-Commander H. H. Gorringe, U. S. N., read a paper entitled, A cruise along the northern coast of Africa.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

The Geological Magazine.—March. On the traveled blocks of the Upper Pūnjab and a supposed Glacial period in India, by A. B. Wynne. Prehistoric Europe and the Cornish Forest beds, by W. A. E. Assher. "Laccolites," by G. H. Kinahan.

The Canadian Entomologist. — January. Observations on several species of Ægeriodæ inhabiting the vicinity of Buffalo, N. Y., by D. S. Kellicott. Description of the preparatory stages of *Papilio philenor* (Linn.), by W. H. Edwards.

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ARCHÆOLOGY OF VERMONT.

BY PROF. GEO. H. PERKINS.

IN a paper published in the NATURALIST for December, 1879, the writer attempted to present the chief physical features of the Champlain valley, and to give a general idea of its archæology. That paper may suffice as an introduction to the present and future papers, in which some of the more important groups of archæological objects will be discussed more fully than would be possible in a more comprehensive article. Before proceeding, however, to the main topic of this article, I wish to add a few general statements to those previously given. It has been a cause of some surprise to me to discover a close resemblance between many of our most peculiar Vermont specimens and others from the Mohawk valley and other parts of New York. We should naturally expect to find similarity, as we do, in the specimens found on the eastern and western shores of Lake Champlain, but we should scarcely expect to find many nearly identical specimens in Western Vermont and Central New York. But Mr. Frey, near Palatine bridge, and Rev. Mr. Beauchamp, near Baldwinsville, find stone tubes, carvings, amulets, &c., some of which are precisely like those found in Vermont, but not, at least up to this time, found in the region bordering the western shore of Lake Champlain. In many respects our collections of stone implements and pottery from Western Vermont seem more closely allied to those from the Mohawk and Genesee valleys than to those from other parts of

New England. Vermont is, to a certain extent, divided by the Green mountains into two archæological regions, though perhaps it is not best to make this distinction too prominent. So far as the more recent specimens are concerned, we should expect this to be the case, for, while the early history of Vermont is not very full in its account of the Indians whom the white men found, we are told a few facts respecting their habits, and among other things that those living on the western side of the Green mountains rarely crossed them. For instance, Hall, in his "History of Eastern Vermont," page 585, says: "The Iroquois seldom crossed the mountains, and have left few marks of their presence in the eastern part of the State." He goes on to tell us that, "the country in the neighborhood of Lunenburg and Newbury (in Northeastern Vermont), and on the side of the river opposite to the latter place, was called by the Indians "Coos," which word in the Abenaqui language is said to signify "the Pines." At this point and at other localities on the Upper Connecticut, formerly resided a branch of the Abenaqui tribe. These Indians were called Coosucks, and being defeated in battle by the white settlers in 1725, they went back to Canada whence they had come, and in 1760 a few returned to Coos. As to the extent of this settlement there seems to be no definite information. In a small work published in 1841 by Rev. Grant Powers, entitled "Historical Sketches of Coos County," on pages 39–40 we find the following: "On the high ground east of the mouth of Cow Meadow brook, and south of the three large projecting rocks, were found many indications of an old and extensive Indian settlement. There were many domestic implements. Among the rest were a stone mortar and pestle. * * * Heads of arrows, large quantities of ashes, and the ground burnt over to a great extent, are some of the marks of a long residence there. * * * * On the meadow, forty or fifty rods below, near the rocks in the river, was evidently a burying ground. The remains of many of the sons of the forest, are there deposited. Bones have frequently been turned up by the plow. That they were buried in the sitting posture, peculiar to the Indians, has been ascertained. When the first settlers came here, the remains of a fort were still visible on the Ox Bow. * * * The size of the fort was plain to be seen. Trees as large as a man's thigh were growing in the circumference of the old fort. A profusion of white flint-stones and heads of arrows may yet be seen scattered over the ground." I have not been able to ascertain the existence of a collection of the above-mentioned implements, and it is probable that like many other similar objects, they were thrown aside by their finders as useless. This is to be regretted, as a collection of stone implements, the locality of which was certain and also the tribe that made and used them, would be of great value to us as a basis of a more definite ethnology than is at present possible, or probably ever will be.

Proceeding now to special groups of objects, we will first examine those implements commonly known as "gouges," and which for convenience will be so designated in the following pages, though, as will appear, it is not the belief of the writer that all, if any, of them were used for the purposes for which our modern gouges are designed. I have chosen this class of implements for description before all others, because, as archæologists well know, they are eminently characteristic of eastern collections, very few having been found in the Mississippi valley and none, I believe, in the mounds, and are especially characteristic of our Vermont collections. It seems probable that the gouge is of comparatively modern origin, and was made and used by such tribes or nations as the Algonkins and Iroquois, and were unknown to more ancient peoples. This implement is not, I believe, common in any other part of the world except the Eastern United States; and even here they are not so abundant as to occur in great numbers in our collections, yet they form an important part of them. Presenting great variety in form, size and material, the gouges seem rather to form a class of implements, some designed for one purpose and some for another, than to be simply different forms of one implement. The absence of gouges from large portions of this country, is the more remarkable because we find so many other implements either in identical or similar forms over all that portion of the United States east of Kansas.

The general character and variety in form and material of the Vermont gouges will best appear in the following descriptions and figures, which include all the different classes which I have seen, though each of these may be taken as a type of which varieties may exist. The gouge described on page 744 of Vol. XIII of the NATURALIST, and figured on page 741, may serve as a type of still a different form from any here mentioned, and should properly have been embraced in this article.

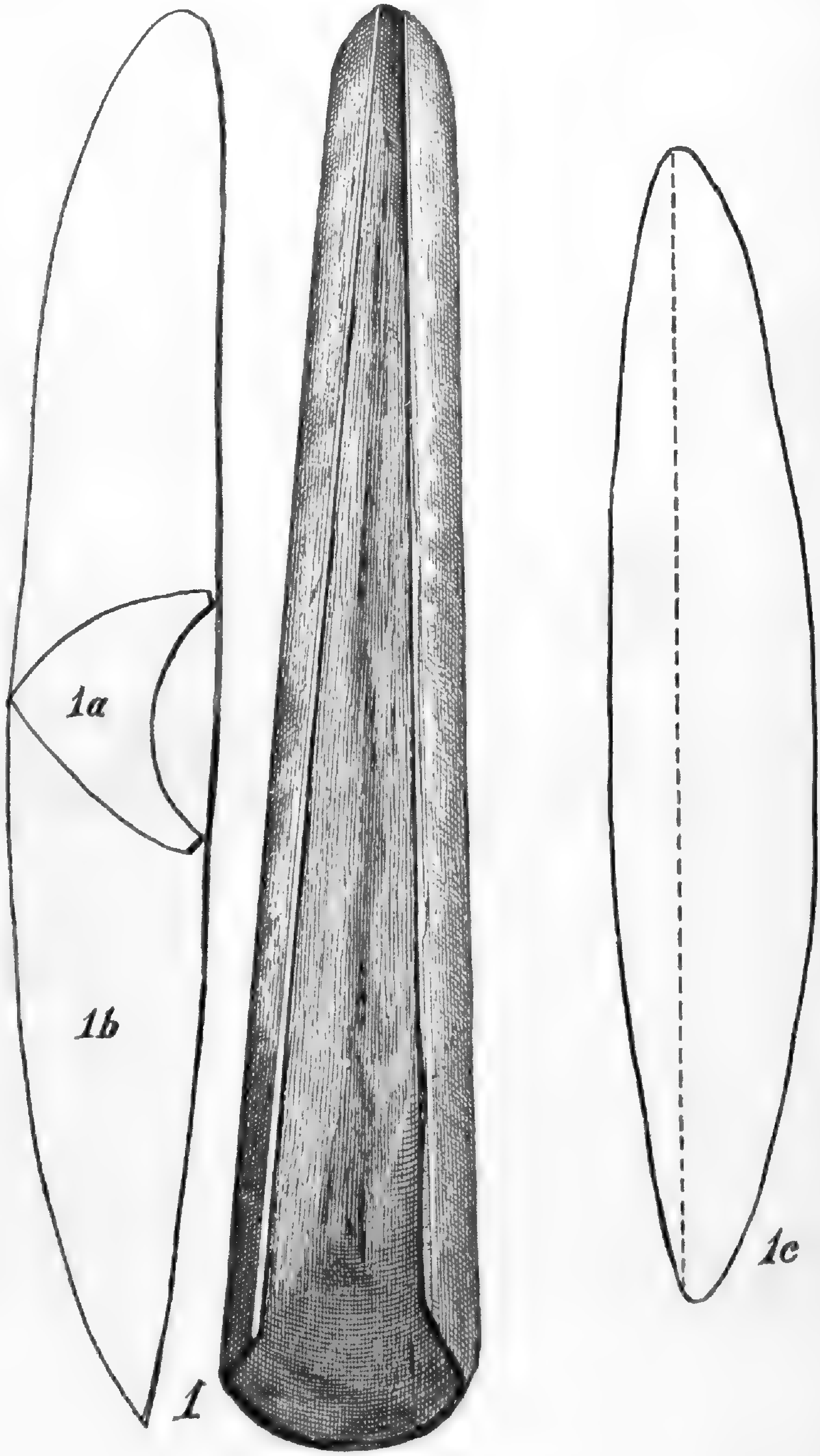


FIG. 1.—Indian "Gouges."

In Fig. 1 we have a representation, reduced one-half, of a specimen which has the general characters of the longest gouges that have been found. In all of these the groove runs from end to end, becoming narrower, as does the specimen itself, towards the upper end. One specimen of this sort is nineteen inches in length. The material is always some hard, compact stone, like basalt, which is wrought into the desired form with very great skill. The specimen figured is 11.5 inches long; its form is very symmetrical, and the surface smooth and in some portions polished. The upper surface is mainly occupied by the groove and there is, on each side of this, a narrow flat portion from which the sides curve downward and approach each other until they meet in a median ridge, on the lower side, so that a cross section is of the form shown at 1*a*. The under side is also curved from end to end, bending upwards rapidly to form the edge, so that a longitudinal section is of the form shown in 1*b*. In most of these implements the main portion of the bevelling at the edge is from beneath, though generally the upper surface is also beveled, often abruptly, downwards. The edge in this specimen is very regularly curved, is sharp, and 1.65 inches in width—the width of the opposite end being less than half as much. Near the edge the groove is .5 inch deep, but grows shallower as well as narrower as it recedes from the end. The greatest thickness of the implement is near the middle, where it amounts to 1.5 inch. Other specimens are wider in proportion to the length, for instance, in one case where the length is somewhat more than 9 inches, the width is, in the widest part, 2 inches. In this specimen we find the widest part about a third of the distance from the edge to the other end, and from this point the width decreases somewhat to the edge, and much more to the other end, and the same peculiarity is seen in the thickness, so that a longitudinal section is somewhat unequally fusiform, the upper side curving less than the lower, as seen in Fig. 1*c*. As the line of the groove, indicated by the broken line in the figure, is straight, the depth seems to be greater near the middle than at either end. In cross section this specimen is like Fig. 1*a* except that it is much broader in proportion to the height. Figure 2 shows a unique form of this sort of gouge. The groove is similar to others, though the edge is not straight, but somewhat oblique. The material is basalt and the specimen was evidently formed with much care and labor, although the surfaces are not polished, but show striæ made by sand used in grinding them. The chief peculiarity of this specimen is in the form of the lower side, which instead of being more or less convex, as in almost all other specimens, is ground in a series of planes, so that in cross section it has the form of *2a*. These surfaces are flat and even, and the edges sharp and true. The groove is very deep and wide. The length of this specimen is 4.75 inches; width, just above the edge, 1.56 inch. This is the only specimen which shows no curved surfaces, except the groove, that I have seen. In some specimens there is a flat space running longitudinally through the middle of the back, but usually even this is convex, or raised into a sharp ridge; many others are flat on the upper side, but in all some of the surfaces are convex. In figure 3 we have another variety of gouge, in which, as in the foregoing, the groove extends throughout the length, but in this case each end is brought to an edge, and the sides do not converge at one end, as in the specimens thus far mentioned, but are parallel, and the groove is of equal width throughout. One end, as the figure shows, is broken. The under side is very regularly convex. The material is basalt, and the surfaces are pretty well finished. The length is 5.65 inches; width 1 inch. Col. Whittlesey figures on page 117 of the "Ohio Centennial Report," what he calls a "gouge-form skinner," which is somewhat like the above, and mentions three other Ohio specimens which he has seen. Although gouges in which the groove extends through the entire length are not uncommon, yet this is not the form of nearly all such implements. More have a groove which extends only a short distance from the edge. Figures 4 and 5 show the opposite sides of one of this

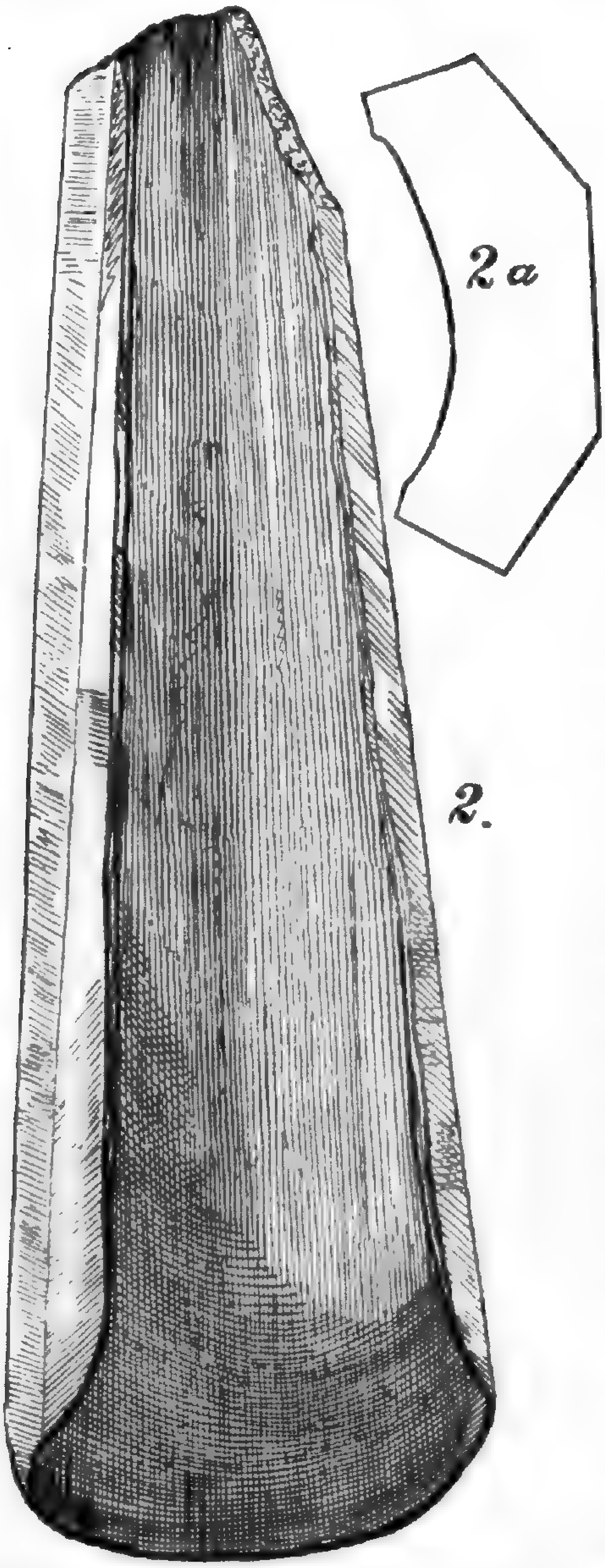
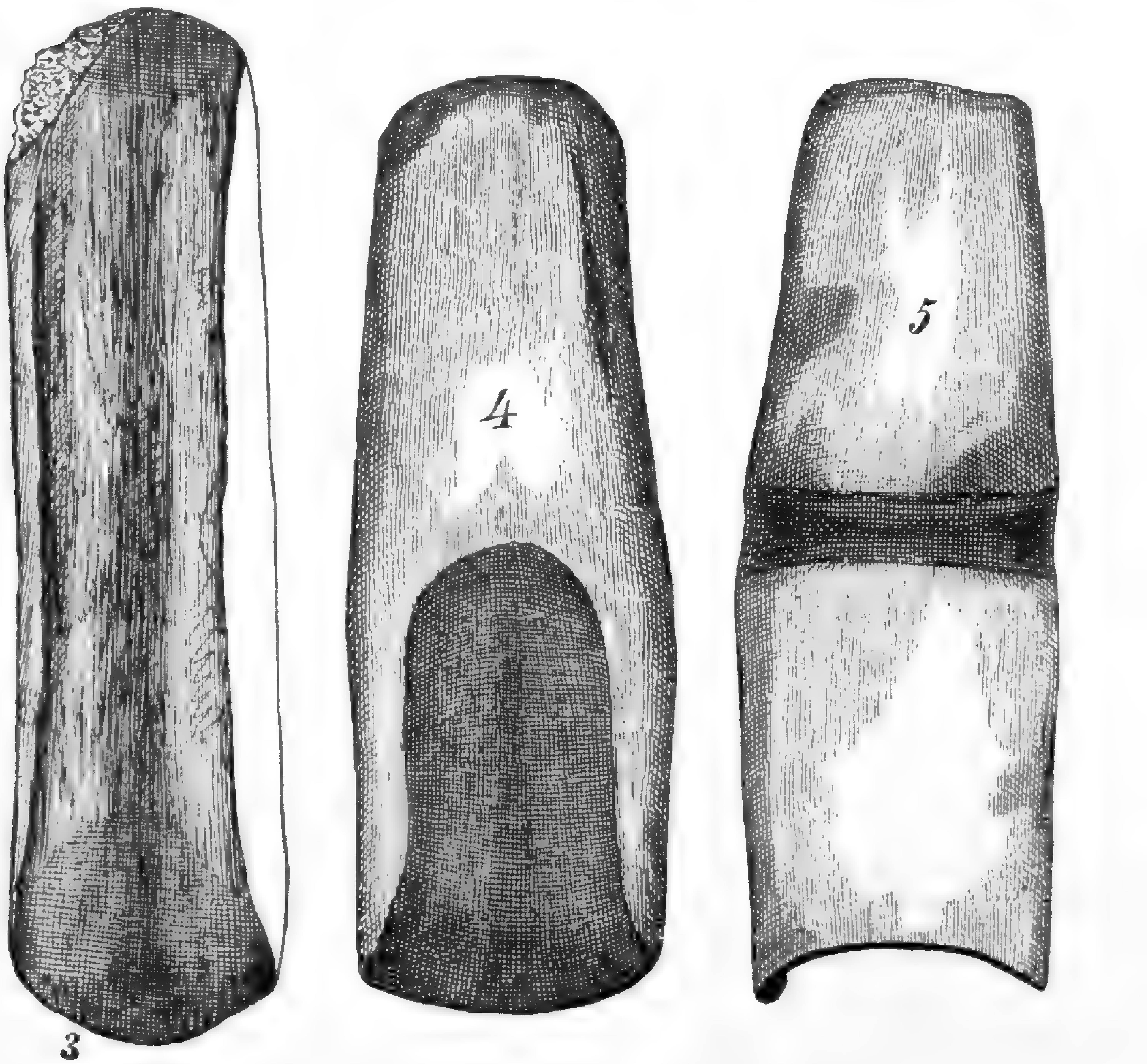


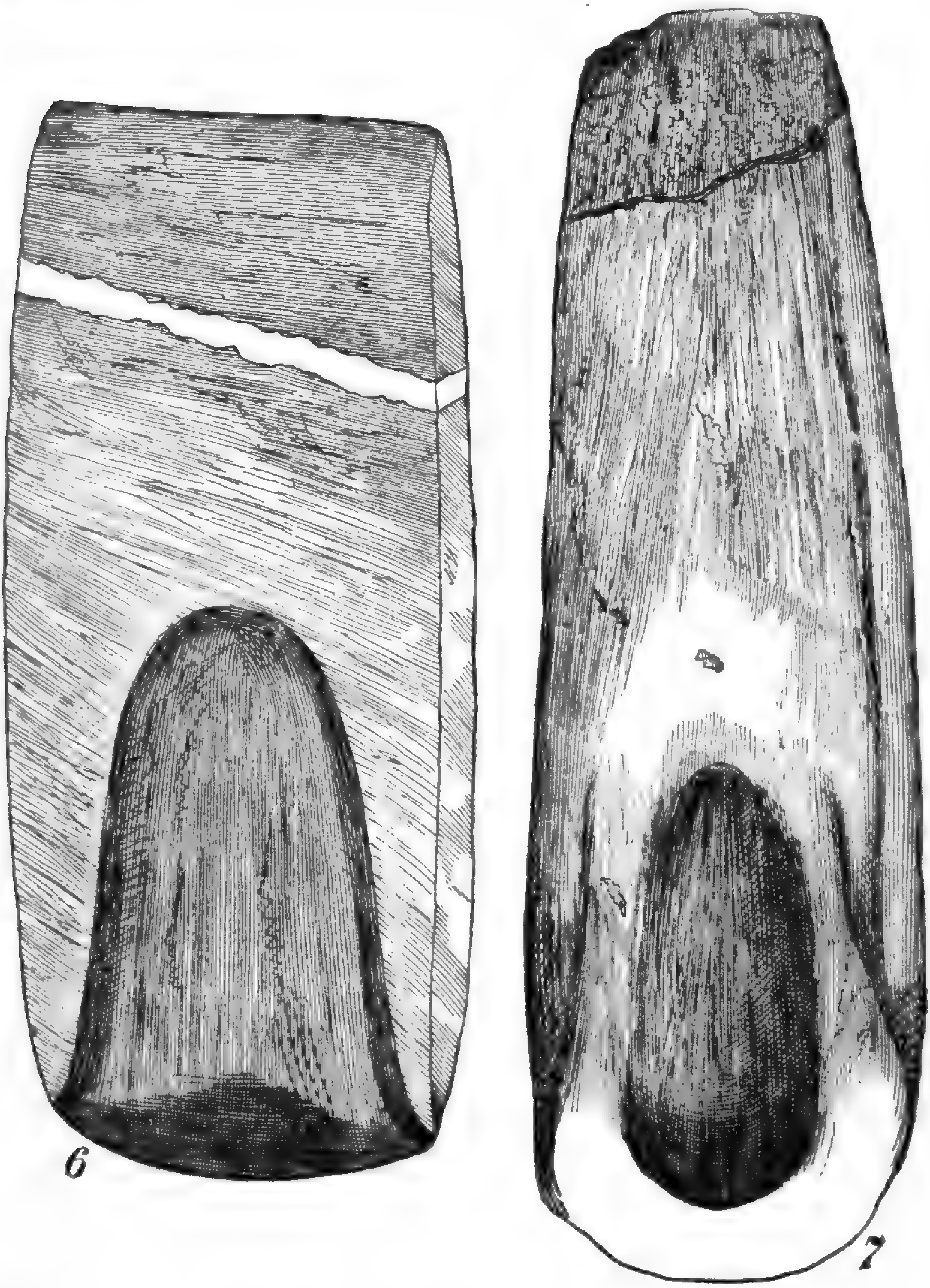
FIG. 2.—Indian Gouge. Reduced ½.

kind. This implement, the general form of which is shown in the figures referred to, is convex on both surfaces, so that a cross



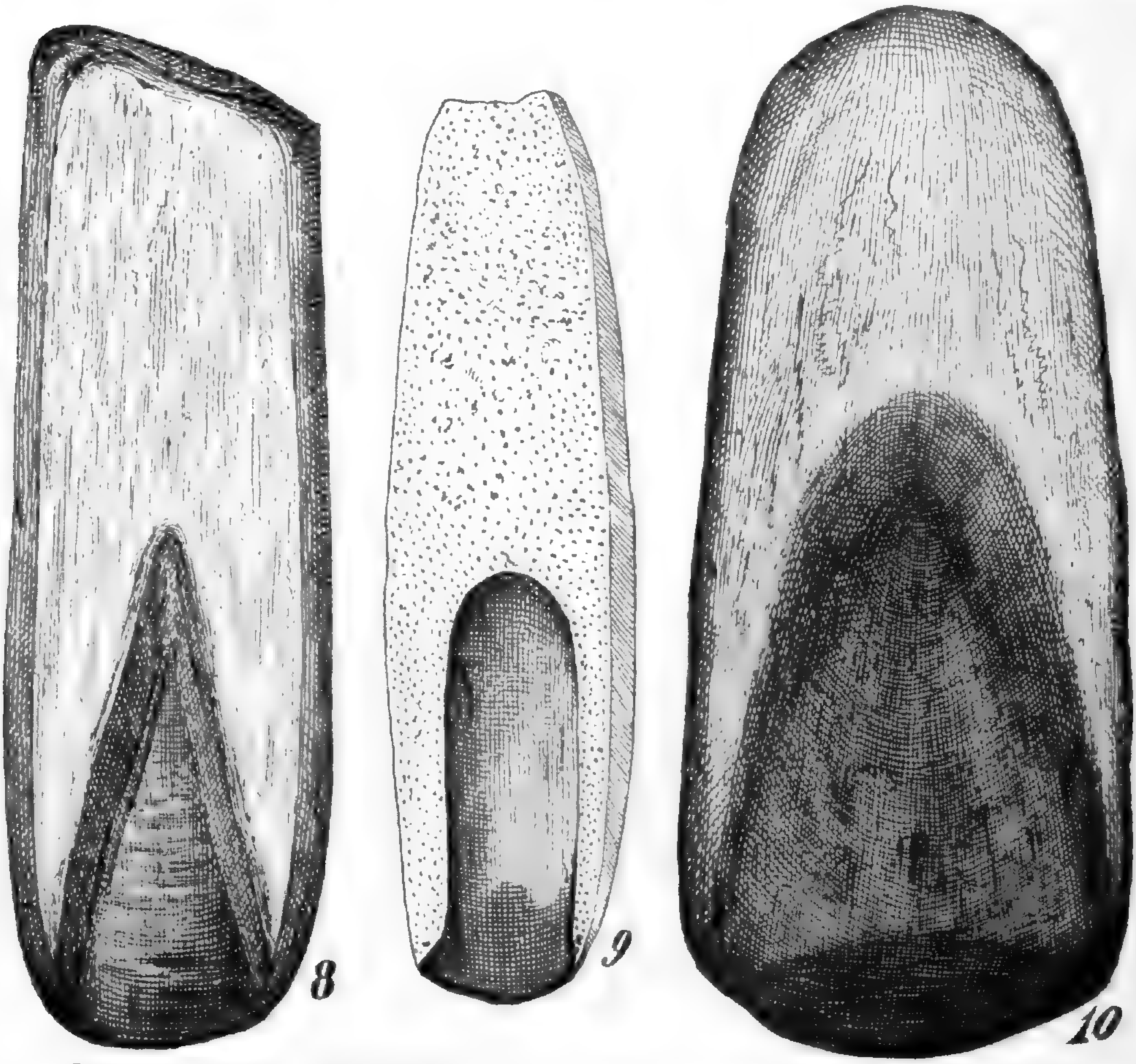
FIGS. 3, 4, 5.—Indian Gouge. Reduced one-half.

section is oval. The groove, regularly rounded above and in every way well formed, is well polished. Indeed, it is scarcely necessary to mention this, for whatever may be the character of the other parts of one of these specimens, the groove, and usually the adjacent portions, is always well finished and polished. As seen in figure 5, this specimen has, across the under side, a transverse groove, which divides it into two nearly equal portions. I have seen one or two other specimens of similar form, which were similarly grooved. Whether we are to regard this as an indication that the implement was attached to a handle and used as an adze or not may not be clear, but it is difficult to account for this transverse groove in any other way. These grooves are not deep nor worked out with as much care as that at the end. The material of this specimen is a gray talcose slate with the surface very smoothly finished. It is worthy of notice that all the specimens with the groove running from end to end are of hard material, such as trap or basalt, while many of those with a shorter groove, like figure 5, are of the talcose rock mentioned. This is not very hard, but readily takes a smooth surface, and when finished, an implement of this material is often very handsome. Some of the gouges of this material are quite large, though none so large as those first named, or rather they are not so long, but the width is often greater. The basalt gouges are more nearly cylindrical in cross section than most of the talcose ones, which are usually but slightly convex. The latter range in length from four to eight inches. Of the same talcose rock is the specimen seen in figure 6. This specimen is somewhat unique in its rectangular outline and great width, as well as in the chisel-like character of the upper end. I have seen several of this sort —gouge at one end chisel at the other. The chisel end is rather abruptly brought to an edge, which is sharp and even, as is the opposite edge. The material is of a bluish color with a vein of white running across the upper portion. The sides are flat and form sharp angles with the upper and lower surfaces, but they are not parallel, but slope so that the surface seen in the figure is narrower than the opposite. The thickness is greatest near the white band where it is nearly an inch, and from here it grows less towards each end. The width is about the same, 1.75 inch throughout. The length is 4.5 inches. The whole specimen is well finished. Figure 7 shows a very singular gouge-like implement of green gneissoid stone. It is of regular form and well made, those parts of the surface that have not been injured being smooth. The surface shown is flat, or nearly so, while the opposite is somewhat convex. As the figure shows, the groove, which is short and somewhat irregular, does not reach to the end, but stops about a fourth of an inch from it, leaving a space which is ground very smooth and quite strongly bevelled from the end of the groove to that of the implement, and the lower surface is bevelled about this edge so that it is thin and sharp. The use of the groove is not at all apparent in this implement, which, judging from its form, was probably used resting on the bevelled portion between the groove and edge with the groove down. The groove is quite deep and well excavated, but somewhat one sided. The length of this specimen is 5.3 inches; greatest width, 1.65 inch; thickness, 1.15 inch. Another singular specimen, which should, perhaps, be classed with the above, is quite rudely made of a dark, micaceous rock; it is triangular in outline, being at the edge 1.9 inch wide and growing narrower towards the other end, which forms a blunt point. In



FIGS. 6, 7.—Indian Gouges. Full size.

thickness the reverse is true, as this is over an inch at the upper end, from which it grows less towards the edge. The groove, if it can be called such, is a small elliptical excavation about a fourth of an inch from the edge. This implement probably shows us the most rudimentary form of the gouge; indeed, it is essentially a chisel with a small hollowed out space on one surface near the edge. The length of this specimen is 5.2 inches. Figure 8 exhibits another type of gouge of which I have seen quite a number of specimens. In these the excavated portion is triangular and not concave, but with straight sloping sides inclosing a space



Indian Gouges. Figures 8 and 9 reduced one-half; figure 10 full size.

nearly or quite flat, and terminating in a more or less straight edge. The upper surface is flat, and from this the sides curve regularly until they meet behind. The thickness is relatively greater than in other forms, and the appearance suggests the thought that the form was at first cylindrical, and the flat upper surface ground down afterwards. The upper end, while not very evenly shaped, is yet ground smooth and finished like the rest of the implement. The specimen figured is shown one-half full size, being 7 inches long, 1.9 wide and 1.5 inches thick. The sides are straight and nearly parallel. The material is a dark steatite, harder than this material usually is. Other specimens are of syenite and porphyry, and are larger than this. Besides the specimens with triangular groove and parallel sides, as in figure 8, there are other gouges, with somewhat similar grooves, which taper from the edge almost to a point. One of these of the hard black limestone found abundantly in many parts of Western Vermont, is rather rudely finished, the pick-marks being conspicuous. This specimen, which is 8 inches long, has a very wide, short groove, which shows a peculiarity seen to a less degree in other gouges. It is deeper on each side so that a convex portion occupies the median part of the groove, thus affording a hint of the manner in which the excavated portion was worked out, at least in some cases, *i. e.*, by rubbing or grinding out a narrow groove on each side of the implement and then removing the space included between these. It is possible that some pointed hammer or other implement was used in the excavation of the groove, but only a very few specimens indicate this in any way; in nearly all, the smooth surface, sometimes striated, suggests that the whole was ground out by using sand with some cylindrical instrument. In one specimen, in which the groove is triangular, though concave transversely instead of being flat, as in the above, we find the upper end brought to a chisel edge somewhat like that shown in figure 6, though this latter is much less highly finished, indeed, its material, a sort of mica schist, precludes much elegance in the finish. It is a small implement, being but 4.25 inches long. Both surfaces are flat, and the sides rounded. Figure 9 is a fine specimen, made of a compact, mottled stone of a greenish hue. The surface is smooth, though not polished, except near and in the groove. The surface shown is flat and the edges along the sides are sharp. The lower surface is convex. As is often the case, the thickness is greatest, 1.8 inch, near the middle, and from here the under surface slopes to each end. The form of the groove and of the specimen itself may be understood from the figure. This is a large gouge, as it is 9 inches long and 1.65 inch wide at the edge. The upper end is somewhat rude, but all the rest shows that much care was exercised in making it. There is a species of gouge which is found in various parts of the State quite unlike any of those mentioned. The implements of this sort are of small size with a blunt, rounded edge, wholly unfitted for cutting or even scraping. In some cases, perhaps, this thickness of the edge should be regarded as the effects of use, but it is so regular and of such a character, that I have no doubt that it was intended to be so. Figure 10 shows one of this sort. The material of all is rather soft, and the surface is not ground so smooth as in many gouges of other forms. The groove is shallow, long and wide, and, as has been noticed, the edge is not sharp. The surface shown is flat, the lower regularly convex. The length of this specimen is 3.5 inches, width across the edge, 1.6 inch, and the thickness in general about .5 inch, though in places more. Still farther removed from gouges with cutting edges, are specimens with a very shallow groove, and with the grooved end not brought to an edge or anything like it, but only worked somewhat thinner than the rest of the implement and then evenly rounded. These are made from talcose or schistoze rocks and hence are not very hard.

A comparison of the figures given with these pages will make evident several facts worthy of notice. As the reader has probably discovered, I have included under the name "gouge" a variety of specimens, some of them without very much in common, but it has seemed more convenient to do this than to attempt a subdivision of the group into classes. The term groove has also been for the same reason used to designate the excavated portion of each implement, whatever its character may be. We have seen that in some the edge is straight, in others curved, in some concave, in others flat, and the groove is found in all gradations between a very simple, oval depression and one elegantly wrought and extending through the entire length of the specimen, as in figure 1. In most, the lower surface, by which is always meant that opposite the groove, is convex, both transversely and, to a less degree, longitudinally, though in a few cases the thickness is greatest, not near the center, but at the upper end. This end in nearly all specimens is narrower than the other. In many specimens this end is rough and broken, or splintered, but not in all, for there are specimens in which this end is as smooth as any part of them.

A gouge in which the edge shows signs of hard usage is very uncommon. These facts must be considered when we attempt to discover the purpose for which these implements were designed. I have searched the writings of Champlain and other early explorers for some mention of these implements, and some hint as to their use, but thus far in vain, and without some such aid, theorizing upon the use of these, or any other such implements is of little value. The most plausible theory for the use of the gouge, is, perhaps, that it was the chief implement used in excavating dug-out canoes. Champlain gives a very brief account of the manner in which some of the Indians whom he met on the coast of Maine, made canoes, and tells how by charring and scraping away the charred wood and again charring it, the desired form was obtained, but he does not give us any definite idea of the form or character of the stone implements with which the work was accomplished, and we know that in many parts of the country, canoes were chiefly made of elm or birch bark. Evans seems to incline towards this view in speaking of the "hollow chisels" of flaked flint found in Denmark, and far less abundantly in England, as he states that they are found chiefly where canoes would be most likely to have been used. We also learn from old writers that gouges made from the columella of the conch, were used by southern tribes for scraping away charred wood in making canoes, and Evans, quoting another, says: "On the western coast of North America mussel shell adzes are still preferred by the Abts to the best English chisels for canoe-making purposes." Bone gouges are also common in the south, more so, according to Col. Jones, than those of stone. I have never seen any other than a stone gouge in Vermont. That some of the specimens figured, or such as they, were thus used, either held in the hand or attached to a handle as adzes, is quite probable, but that all were so used does not seem so. Another theory has been suggested, that the gouges were intended for use in tapping maple trees in the sugar making operations of the aborigines. I cannot see any basis of probability for this theory to rest upon. If this view were correct, we should find gouges most abundantly near those places where the sugar maple is most abundant, but this is not the case, at least in Vermont. On the uplands where the sugar maple now grows, and has for a long time, we do not find gouges as we do on the lowlands and meadows. While the form of such a gouge as that shown in figure 1 might suggest such a use as that just mentioned, the form of most would certainly be a strong argument against such use, and the material of which many are made is such as to unfit them for cutting hard wood such as that of the sugar maple. It is a remarkable fact that so many of our gouges appear to have seen so little service. It would seem certain that implements requiring so much labor for their formation, and made with such care, must have been designed for some important service, but even those of the comparatively soft talcose rock have as sharp and apparently unused edges as if just made, the polished groove and edge often not showing even a scratch or notch. Some of them are worn, especially some of the smaller specimens, but most are not. Another noticeable fact, which perhaps might be less so in a larger collection, is that each specimen has certain peculiarities of its own, so that it is quite difficult to find duplicates, though they do sometimes occur, but each specimen seems to have been made according to the present fancy of the maker, and this appears to have varied somewhat as each new specimen was undertaken. This variety in form, size and material indicates that the gouge was not an implement designed for a single, limited use, but that, whether we can ascertain the use of the various kinds or not, their uses were as varied as their form and material. Gouge-like implements have been figured as skin dressers by some authors, and this, it seems to me, suggests better than anything else the probable explanation of the character of these implements. If used in cleaning adhering bits of fat or muscle from the skins so generally in use among the aborigines, the edge would remain unworn for a long time, even if the implement were made of no very hard material. It may not improbably be true that some were used in excavating the charred portions of a log selected for a canoe, but it seems more probable that most were used, in one way or another, in the processes of preparing skins for clothing or for whatever other purposes the skins may have been needed.

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LARVAL HABITS OF BEE-FLIES.[1]

BY C. V. RILEY.

THE bee-flies (Bombyliidæ) are a family of Diptera that have a rapid, darting flight and hover over flowers, from which they extract nectar by means of a long proboscis which is a characteristic of most of the genera. They derive their popular name of bee-flies, or humble-bee flies, from their general resemblance to bees, due to the hairiness of the body, and enhanced by

[1] Adapted from the Second Report of the U. S. Entomological Commission, to which the publishers are indebted for permission to have impressions of the plate made at their expense.

the humming which they produce in flight. Nothing had been published of their larval habits in this country till last year, though an undetermined larva, at first supposed to be Hymenopterous, but which subsequently proved to be that of Systœchus, was figured in the writer's ninth report on the insects of Missouri (1877), and copied in his "Locust Plague in the United States," and into the First Report of the U. S. Entomological Commission.

In October, 1879, we obtained from a lot of larvæ sent us by Mr. G. M. Dodge, of Glencoe, Neb., a single pupa which agrees with those of *Systœchus oreas* O. S.,[1] presently to be described, but which, as Baron Osten Sacken writes us, is probably that of *S. vulgaris*, a common species in the Western States, east of the mountains.

During the past two years we have been in correspondence with Professor J. G. Lemmon, of Sierra Valley, Cal., who has kindly sent us many specimens of locusts occurring there, and especially the eggs and early stages of *Camnula pellucida*.

Among such eggs these bee-fly larvæ were, if anything, more common than we had found them among the eggs of the destructive locust, *Caloptenus spretus*, east of the mountains. We here quote one letter in illustration:

"By this mail I dispatch another cigar box filled, this time with sods containing eggs of the terrible locust that for three years past has devastated Sierra Valley; also the large, fat, white larva that lately made its appearance as a voracious feeder upon locust eggs. We don't know certainly what this larva becomes, but at a venture he is hailed with great joy.

"The ground that was first filled with locust eggs by the *Œdipoda atrox*, by the end of September looked as if scattered with loose shells, so thorough was the work of destruction.

"A few of them were detected in among the eggs in April, but not generally until August. One individual seems to empty several egg cases before retiring from the feast and coiling himself up in a case which he has emptied, or in a nidus of his own make."—[J. G. Lemmon, in letter to C. V. Riley, October 12, 1879.

During 1878 and 1879 we failed to rear any of them to the perfect state, but on June 20 of the present year, 1880, we obtained from these California larvæ the first fly. This proved to be a male of *Triodites mus* O. S.,[2] as kindly identified for us by Mr. S. W. Williston, of New Haven. We have, during the sum-

[1] Western Diptera, p. 254; Bull. Hayden's Geol. and Geog. Survey, III, No. 2.
[2] *Ibid*, p. 246.

mer reared many additional specimens of this species, and also of the *Systœchus oreas* O. S., already alluded to. Professor Lemmon and his brother, Mr. W. C. Lemmon, have also succeeded in obtaining the mature flies, and have observed this Systœchus abundantly buzzing about over the ground in which the locust eggs were laid, as the following extracts from the correspondence of these gentlemen will show:

"An enemy which has proved very destructive in Sierra Valley and vicinity is the larva of, as yet, an unknown insect. It is first observed as a large yellowish-white grub about half an inch or even three-fourths of an inch long when extended, it being usually curved so that the head and tail nearly touch. It is one-sixth to one-fifth of an inch thick just back of the head, and tapers slightly towards the tail, also flattened slightly dorsally. It is usually found in a case of locust eggs which it has devoured, pushing the empty shells aside, and at last occupying the space where were twenty-one to thirty-six eggs. Often it is found in a little space below a number of emptied cases, as though it had feasted off the contents of several nests.

"The grub was first noticed last April 20, in the egg deposits near Loyalton. This fall, September 7, it was detected in great quantity near Sierraville, and afterwards in several infested spots of the valley. A handful of such soil will generally display ten to twenty cases of locust eggs, more or less emptied, and half as many of the fine, fat grubs."—[J. G. Lemmon in the Sacramento, Cal., *Weekly Record-Union*, November 29, 1879.

"The white grubs ate out and destroyed thousands of eggs last fall, but, to all appearance, have eaten nothing since, having lain dormant all winter, and being now found still among the eggs, which are fast hatching out."—[W. C. Lemmon, Sierra Valley, Cal., June 13, 1880.

"I send you by this mail another package of the locust-egg-eating grubs, some of which you will find more developed. My brother, Professor J. G. Lemmon, came up from Oakland day before yesterday to spend a few days, and while looking at the grubs that I had gathered for you yesterday, one of them developed into the humble-bee fly which you have bred, and a half dozen specimens of which I have caught and envelop rolled up in paper."—[W. C. Lemmon in letter to C. V. Riley, dated Sierra Valley, Cal., July 18, 1880.

"Happening home on a hurried visit, I find locusts and destruction all around—a sad, sad sight! Find my brother has tried to keep you posted up with specimens and notes. Am pleased to see a solution of the "big white grub" question. He developed into a species of fly, hosts of which are now seen in midday, buzzing about among the locusts."—[Professor J. G. Lemmon in letter to C. V. Riley, dated Sierra Valley, Cal., July 18, 1880.

C. V. Riley del. et pinx. A. Hoen & Co. Lithocaustic Baltimore

BEE-FLIES.

This habit in the larvæ of Bombyliids of preying on locust eggs has not before been suspected, and in this connection we will review what has hitherto been known of their habits.

Professor J. O. Westwood has given, in the Transactions of the Entomological Society of London, 1876, pp. 497, 498, the following summary of observations upon the larval habits of Bombylii:

"Thanks to the researches of previous observers, the economy and transformations of the Bombylii are now satisfactorily known to entomologists. Latreille rightly considered that the Bombylii, like Anthrax, were parasites, contrary to the opinion of Zetterstedt that the larvæ feed on the roots of plants (Ins. Lapp., p. 510). The pupa of *Bom. major* was first figured by M. Imhoff, in the *Isis* for 1834, having been found by him in a situation which he had previously noticed to be frequented by *Andrena humilis* (Vol. 1834 p. 536, pl. xii). In my Introduction (Vol. II, p. 538, 1840) I published a figure of the same pupa from a specimen discovered by M. C. Pickering in a sandy gravel-pit at Coombe Wood, on the 28th of March, from which the imago was produced in a few days. The pupa is very similar to those of the species of Anthrax, which are known to be parasites; having the front and under side of the head armed with strong spines, and the dorsal segments of the abdomen furnished with transverse rows of strong reflexed hooklets. In 1852, M. H. Lucas published the description of a new Algerine species of the genus, *Bomb. boghariensis*, in the Annals of the French Entomological Society, 2d ser., Vol. x, p. 11, pl. 1, No. 11, which he had reared from a pupa found under a stone in a damp, sandy situation, and, contrary to the opinion of Latreille, he expressed himself thus: 'Je suis porté à croire que les larves qui composent ce genre ne sont pas parasites, comme le supposent Latreille et beaucoup d'autres Entomologistes, mais qu'elles vivent au contraire isolément dans la terre,—opinion, au reste, qui avait déjà été émise, mais avec doute, par M. Macquart, et que mon observation vient confirmer.'

"In 1858, the real history of the Bombylius was discovered by the veteran Léon Dufour, who in the spring found various exuviæ of the pupa of *B. major* sticking out of the ground, together with the newly-hatched insect, in places much frequented by various Andrenidæ, especially in the autumn, by digging on the spot, to find the larva, 'au milieu des déblais, où gisaient par-ci par-là des coques de Colletes' (Ann. Soc. Ent. France, 3d ser., tom. vi, p. 505, pl. 13, Fig. 111, and details). The larva is elongated, apod and fleshy, and of a white color. The preceding observations clearly prove that the larvæ of the Bombylii are parasites in the nests of other insects, in the manner of the cuckoo among birds."

The last statement of Professor Westwood is, however, not justified by Dufour's observations. On the contrary, Dufour expressly states that he did not observe upon what the larva fed; the inference which he draws is based upon the analogy of Anthrax, and he inferred that it was upon the larvæ of Colletes that the grub fed; quite a different thing from being a cuckoo in the nest and feeding only upon the pollen. There is, in Dufour's paper, no evidence to prove that the Bombylius larva was found in the coccoons, or even in the cells of the bee; he states, in fact, that he failed to find it there, but found it among the clearings *(déblais)* which he had made in digging out the nests. Professor Westwood himself found numbers of *Bombylius medius* flying in association with a species of Andrena in the unpaved Forum Triangulare of Pompeii, and found at the same spot the pupa-shell of the fly protruding from the ground.

As early as 1838, Macleay (Ann. N. H., Vol. II, p. 12), stated that he had "discovered that the larvæ of those tropical Bombylii which have such a bee-like form live on the larvæ of the bees they so strikingly represent," although he gives no particulars of his discovery.

Dr. Morelet, in 1854, recorded the fact that he had obtained a Bombylius from a nest of *Halictus succinctus* (Bull. Soc. Ent. de France, 1854, p. XXIV).

Dr. Packard ("Guide," &c., p. 397) states that "a species [of Bombylius] is known in England to lay its eggs at the opening of the holes of Andrena, whose larvæ and pupæ are devoured by the larvæ of the fly." But no authority is given for this statement.

Messrs. Allen and Underhill, in *Science Gossip*, 1875, p. 80, express their belief that the Bombylii are parasitic on humble-bees. In the volume for 1876, p. 171, they say (speaking of Sitaris):

"In relation to the larva of this beetle, we would remark that this year we have found it clinging to Bombylii. This is 'circumstantial evidence' that Bombylii frequent the nests of Anthrophora to lay their eggs, since Sitaris itself, from its manner of life, cannot be the parasite of a fly, but only of a bee."

Schmidt-Goebel, as Baron Osten Sacken has pointed out,[1] reared one of the smaller unicolorous Bombylii from among the pupæ of *Colletes fodiens* (Stettiner Ent. Zeit., 1876, p. 393), which so infested a clayey bank that he could not place his thumb anywhere without discovering an entrance to a burrow.

Finally, Dr. T. Algernon Chapman *(Ent. Monthly Mag.*, Feb.,

[1] *Entom. Monthly Mag.*, Feb., 1881, p. 206.

1878, p. 196), as shown in the February number of the NATURALIST, gives abundant proof of the parasitism of *Bombylius major* on *Andrena labialis*.

From these records of European observations, it is sufficiently certain that some of the Bombyliids develop in the cells of mason and burrowing bees, but whether as true parasites on the larvæ of the bees or as partial parasites on the pollen-paste stored up by the same, as in the case of the larvæ of some of the Meloids, does not seem to have been observed. The former is most probably the case, however, for it has been clearly ascertained, and is well known, that Anthrax feeds in the larva state upon the young of certain bees. The larva of the Anthrax before attaining its own full growth and before destroying its host must await the full growth of the latter, as it has, by several observers, been bred from the cocoons of the insects upon which it was parasitic.

In his "Western Diptera" *(l. c.* p. 243) Baron Osten Sacken gives references to the published account of the parasitism of the Anthracid genus Argyramœba within the nests of Cemonus and Chalicidoma; cites Schiner's statement that the larvæ live parasitically in pupæ of Lepidoptera, and records the breeding of *A. cephus* and *A. fur* from the nest of a Texan mud-wasp, which he referred, with a question, to Pelopœus, but which, as we have ascertained from an examination of the mud tubes which are deposited in the Cambridge Museum of Comparative Zoölogy, belong to Trypoxylon. We have similar cells from Texas and other parts of the South. They differ from those of Pelopœus in being wider, ribbed on the upper surface, and fastened not only side by side, but in long tubes, end to end. The Pelopœus spins a thin, yielding, semitransparent, elongate cocoon of a golden-brown color, with more or less loose silk around it, and the tail end thickened and docked; the Trypoxylon spins a tougher, thicker, more solid and smooth cocoon of a dull, dark-brown color, generally about half as long as the other (but varying greatly in size), and with the head-end often expanding into a flange.

We have reared what is very near to and probably identical with *Argyramœba fur* from larvæ that had preyed on *Trypoxylon albitarse* which had made use of the mud cells of *Pelopœus lunatus*, or the common mud-dab, in Texas; also from the same wasp that had made use of the burrows of a bee (*Anthophora abrupta* Say). The larva of Argyramœba has very much the same appearance as that of Systœchus and Triodites, and the pupa is distinguished from the pupa of this last (Pl. VI, Figs. 5, 5 *a*), principally by its longer and more numerous hairs, longer anal spines, and more conspicuous spiracles.

Systropus also, in the larva state, preys on the larva of Limacodes, as has been observed by Walsh (Proc. Bost. Soc. N. H. IX, 300), and by Westwood (Trans. London Ent. Soc., 1876, p. 571), killing its victim only after the latter has formed its tough cocoon.

With these general remarks, we will now give a more full and descriptive account of the two bee-flies which, by rearing from the larva, we know to have this locust-egg-feeding habit. Our plate illustrates the insects as well as can be done in color printing, but the enlarged heads of the larva should be somewhat darker and less yellow.

SYSTŒCHUS OREAS.—The character of the eggs and the manner in which they are laid have not yet been observed. The larva (Pl. VI, Fig. 1) is found in the locust egg-pods, or near them, of different sizes, during most of the year. These larvæ begin to transform to the pupa state early in the summer, and the pupa (Pl. VI, Fig. 2) pushes itself half way out of the ground in order to disclose the fly. These flies continue to issue during the summer months. As a rule, but one year is required for full development, but there is, in this respect, great irregularity, and the same tendency to retardation which we have called attention to in the case of the blister-beetles.[1] We have had quite a number of the larvæ remain over unchanged till the second year, and all that we have said as to the philosophy of this retardation in the one case applies in the other.[2] We are inclined to think that future obser-

[1] *Am. Entomologist*, III, 196.

[2] This irregularity in the development of individuals is noticeable in many insects that are parasitic, and whose mode of life is precarious. In the case of our blister-beetles, depending as they do on locust eggs, and especially in the case of those which feed particularly on the eggs of migratory species, it is not difficult to perceive how this trait may prove serviceable to the species possessing it. Migratory locusts occur in immense numbers, in some particular part of the country, at irregular intervals, and there are periods or years of absolute immunity from their presence in the same regions. The young blister-beetles that hatch the year following the advent of the locusts in immense numbers may frequently find few or no locust eggs upon which to prey, and the great bulk of them would, as a consequence, perish; while the young from such exceptional individuals as should not develop till two, three, or

vation will show that there is a still further parallel, in that the newly-hatched larvæ of the bee-flies are much more active than the later stages, and somewhat different in structure.

The three later stages of the insect may be characterized as follows:

Larva (Pl. VI, Fig. 1).—We quote herewith our former description:

"Average length, 0.50 inch. Body curved, glabrous, tapering posteriorly, swollen anteriorly. Color opaque whitish, with translucent yellowish mottlings, and some venous marks at sutures, especially along medio-dorsum. Sutures deep. A lateral row of swellings. Head small, flattened, dark brown, in five pieces, consisting above of a frontal ovoid piece and two lateral pieces of somewhat similar form, and each bearing near tip a minute, two-jointed palpus; beneath of two broad, subtriangular jaws, having forward and lateral motion, and each, also, bearing near the center, in a depression, a two-jointed feeler. A spiracle each side in a fold between joints 2 and 3, and another on each side of the penultimate joint, 12. None otherwise perceptible."

With additional material we have been enabled to examine more fully the structure of the head. Underneath the median elevated piece which may represent the labrum, we find two stout spines (Pl. VI, Fig. 1 *e)*, faintly notched on the outer edge, which are doubtless the mandibles, and correspond to the two dark lance-like mandibles of other Dipterous larvæ, for they are retractile and run back into the thoracic joints, and remain after the other trophi are detached. The pair of feelers upon the upper lateral pieces, which seem to have no motion, might then represent the antennæ, and the two lower jaws the maxillæ with their palpi, while the labium is shown in a chitinous point visible only when the larva extends and raises the other parts. A peculiarity in the movement of the maxillæ or the lower pair of horny pieces is worthy of note. They move in alternation with one another in the forward and backward, *i. e.*, up and down, motion. The palpus of these lower pieces when viewed from above is, as represented in the figure (Pl. VI, Fig. 1 *d)*, circular, with two dark marks indicating minute appendages.

When the larva is fresh and plump it shows the greater swelling of the thoracic joints and the translucent mottlings mentioned

more years after a locust invasion might stand a much better chance of finding appropriate food, and of thus perpetuating the species. In this case and in most other cases of retarded development with which we are familiar, the exceptional retardation may and does become a benefit to the species, enabling it to bridge over periods of adversity. And we can see how, by the preservation of such favored individuals, the habit of irregular development may have become fixed in the species as a consequence of surrounding conditions and circumstances which render it advantageous.

above. Toward the period of pupation, it becomes more opaque and more contracted.[1]

Pupa (Pl. vi, Fig. 2).—Average length 8.5 mm. Color honey-yellow, but varying with age, the head and thorax assuming a dark color with maturity. Head narrow, with two sets of three stout, dark spines on the top, all on a common prominence, the two lower ones of each set connected at base; a pair of smaller frontal spines near the base of proboscis, which is protuberant and laid along the breast, extending to near the tips of the wings; the face with two parallel depressions running from between the triple tubercles ending in two fossæ above the frontal spines; two basal, medio-dorsal tubercles. *Thorax* unarmed, the prothoracic spiracle very large and raised on a curved tubercle; mesothoracic spiracle on a swelling at base of wings; front tibiæ stout and curved; front tarsi reaching to tips of wings; middle tarsi to abdominal joint beyond, and hind tarsi to third abdominal joint beyond. *Abdomen* curved, with the ninth joint very small; across the middle, dorsally, each joint has a series of parallel, longitudinal, narrow, chitinous plates having at each extremity a spine, the posterior one stoutest; both plates and spines diminishing laterally, gradually aborted on the extreme basal and posterior joints, and replaced on the small ninth joint by a group of four converging and truncate tubercles; two stouter anal spines on the subjoint and a ventral lobe with two short, obscurely articulate processes; each abdominal joint with a circle of hairs, those on lateral ridge stoutest and one-third the width of abdomen in length; eight pair of abdominal spiracles (making ten with those on thorax), the first and last pairs rather difficult of detection.

Triodites mus.—The habits of this insect in the larva state are precisely like those of the preceding:

Larva (Pl. vi, Fig. 4).—So greatly resembling that of the Systœchus that it is well nigh impossible to separate the two with certainty. The head parts are somewhat broader, shorter and less flattened, the maxillæ more blunt, the labrum paler, and the mandibles sharper and with a smoother outer edge. The thoracic joints bulge less beneath and the thoracic spiracle is more sunken and less conspicuous.

Pupa (Pl. vi, Fig. 5).—Easily distinguished from that of Systœchus in the broader and more bulbous head; in the two sets of three stout spines at top being well separated; in the frontal pair be-

[1] So far as we can ascertain, there has hitherto been published no recognizable figure of the Bombyliid larva. Dufour, in his articles above alluded to, describes that of *Bombylius major* very indifferently, and gives a dorsal view which shows little or no relation to the larva here described, while his description and figure of the mouth parts fail to indicate the different pieces we have observed in our larvæ. Yet in general form and structure the true Bombylius larva agrees very closely with those here described, as we know from Dr. Chapman's description.

ing stouter, each with a conspicuous bristle externally; in having a single spine or tooth above these, and another much stouter, erect, recurved spine, bidentate at tip, below them or at base of tongue, which is here represented by a cordate lobe. There is a spine on the front anterior border of each wing; the legs are all shorter; the prothoracic spiracles less conspicuous; the hairs on abdominal joints shorter; the transverse dorsal teeth smaller and in single row; the basal abdominal joint without spines, but with long stout hairs and the dorsal tubercles of abdominal joints nine replaced by a single spine.

EXPLANATION OF PLATE VI.

(Natural sizes indicated in hair-line.)

FIG. 1—Larva of *Systœchus oreas*, from the side; 1 *b*, head from side, still further enlarged; 1 *c*, same from front; 1 *d*, left maxilla; 1 *e*, left mandible; 1 *f*, mesothoracic spiracle; 1 *g*, pre-anal spiracle.

FIG. 2.—Pupa of *Systœchus oreas*, ventral view; 2 *a*, same, side view; 2 *b*, dorsal part of anal end; 2 *c*, prothoracic spiracle; 2 *d*, form of dorsal horny plates and spines on the abdomen.

FIG. 3.—*Systœchus oreas*, ♀; 3 *a*, head of same from side; 3 *b*, antenna of same from above; 3 *c*, antenna of same from side; 3 *d*, mouth parts separated.

FIG. 4.—Larva of *Triodites mus* as it appears when contracted prior to pupation; 4 *a*, head from side; 4 *b*, left maxilla; 4 *c*, left mandible.

FIG. 5.—Pupa of *Triodites mus*, ventral view; 5 *a*, same, side view; 5 *b*, dorsal view of anal parts; 5 *c*, form of dorsal plates and spines on abdomen.

FIG. 6.—*Triodites mus*, ♀; 6 *a*, her head, front view; 6 *b*, her right antenna from above; 6 *c*, right antenna from side.

FIG. 7.—*Triodites mus*, ♂; 7 *a*, his head, front view.

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LATE EXPLORATIONS IN THE GABOON.[1]

BY HUGO VON KOPPENFELS.

TOWARDS the end of last year I again had the good luck to kill an almost full-grown gorilla, whose length was 1.75 meters, and the width of the shoulders 0.89 meters. This gorilla, and a young female, should, by this time, be in possession of Dr. V. von Kraus, Stuttgart. I, by chance, shot the male gorilla in the vicinity of my stopping place on the Eliva-Comi (an inland lake), so that I was able to take a very good cast of it. I hope to be able to take a cast of the next animal I shall kill, but I cannot predict at what time and place I shall get a full-grown male gorilla, and whether the circumstances will allow me to take a cast of him.

[1] From a letter to Mr. H. A. Ward, Rochester, N. Y.

I have already asserted, and I believe it is proved, that there are crosses between the male *Troglodytes gorilla* and the female *Troglodytes niger*, but for reasons easily understood, there are none in the opposite direction. I have in my possession positive proof of this. This settles all the questions about the gorilla, chimpanzee, Kooloo Kamba, N'schigo, M'bouvé, the Sokos, Baboos, etc.

The French savants seem to have a special predilection for creating new species from variations in the form of the skull, such as often occur in this group of animals.

There is but one district which forms the range of the gorilla, and this is situated in the western part of equatorial Africa, and here it exhibits no varieties, while the chimpanzee is found all over tropical Africa, and naturally exhibits considerable variation. The chimpanzee of Northern Guinea differs essentially from that of the southern portion of the same country, and, according to Livingston, the "Soko" differs from both, but is still a chimpanzee. Du Chaillu's Kooloo Kamba, N'schigo and M'bouvé are not distinct species, and this traveler, who is certainly a man of merit but is too credulous, has been imposed upon by the mendacity of the natives, which beggars description. The names N'schigo, M'bouvé, Koola, Baboo, Soko, Quia and Kooloo Kamba are only different designations of the chimpanzee by different tribes. The mongrel progeny of the male gorilla and female chimpanzee discovered by me, is found, but in individual cases, and as such deserves no special name.

I intend in a few days to start on an excursion to the Crystal mountains over the N'tampuny falls. My purpose is primarily to shoot elephants. Du Chaillu's journey to the Oschebas by the Munin-Tampnay did not extend far, as I accomplished, last year, the same distance in six days' marches. I found the population harmless though somewhat suspicious. The whole district is almost unknown, as I encountered, the second day, members of entirely new tribes on the Yoko, Manga and later the Akuke. The population of this region is continually migrating from the north-east to the south-west, and no one will ever succeed in sifting out the relationship of these commingling tribes.

As a point of departure for penetrating the interior from the west, this seems to be one of the most promising. In all directions are districts which are as yet entirely unknown. On the north one could in a short time reach the Buiné, a tributary of the Niger; at an equally short distance in a south-easterly direction, one would reach the Sihari, which empties into Tode lake. The district which it drains also forms the water shed of some of the tributaries of the Congo. Had I the means I would not hesitate to begin this important and promising exploration. With a fund of only $10,000, I would venture upon the undertaking.

From what I have been able to learn, I am led to believe that the mountains of the interior consist of three parallel chains running from N.N.W. to S.S.E., having an average height of about 400 to 500 meters. With the volcanic cone of Cameroon 3600 meters high, and which stands opposite Fernando Po, begins a line of elevation which takes a more southerly direction, and with its continuation south of the Ogowé, the Sierra Compleda, forms the border or palisade mountain range of West Africa. In these mountains, protrusions of granite, generally micaceous, are everywhere visible. Adjacent to this is a reddish-yellow sandstone and slate, often succeeded by a hard gray granite. On the table lands and in the valleys I have observed hard quartzose sandstone of varied colors, elsewhere a light gray quartzite with veins of glassy quartz, and large tracts of crystalline slate. The outcrops of all these strata follow the line of bearing of which I have spoken above. The dip of the layers is different in different places, but is generally eastward at a high angle.

Floods do not occur here as the Muni is formed by the Congu-O'tongo, Banji, Tampuny and Noya, all of which with the exception of the latter are short, because the mountains come so near to the bay; but the Noya flows through a plain in a broad curve parallel with the shore of Corisco bay. Toward the Munda, and with this river the Como and the Rembo—both of which empty into the Gaboon—receive their waters from the Crystal mountains. This chain forms the water shed between these rivers and the tributaries which flow northward into the Ogowé.

The mountains south of the Ogowé, and which run parallel with the Loango coast, have the same general character as the Crystal mountains, but have more bog iron ore on the woody slopes than they, and contain less quartz.

In the rapids of the Ogowé, near Ogotà and Okanda, the rocks consist of gneiss which weathers into wonderful imitative forms.

On the Eliva-Comi and the Sette-Comi, Nyangu, which owe their origin to the sand heaped up along the shore by the very strong surf, we find, among transported stones, roundish masses of quartz which, when broken, show the most beautiful quartz crystals.

The effect of the tides is felt in the labyrinthine estuary of the lower river districts as far as forty miles into the interior. Here the tides act like a dam checking the flow of the rivers, which in the rainy season rise four or five meters, and thus all the adjacent country for many miles is inundated.

With the exception of a few higher points where forest trees grow, the vegetation of this swampy lowland consists mostly of thickets of mangrove, from whence comes, under the stimulus of the tropical sun, the *aria cativa* (malaria) so fatal to Europeans. It is extremely dangerous to travel through the districts where the air is impregnated with poisonous exhalations, and efficient prophylactic measures must be taken if one would escape. It has been my custom to take for this purpose one or two doses daily of quinine, and to wear a respirator of fine wire gauze over my mouth. In the evening I bathe the entire body with salicylic acid mixed with a few drops of spirits of ammonia and of glycerine.

Further up the stream, and beyond the mangroves, and where the water is less saline, we find the Pandanus, the wild date palm *(Phœnix spinosa)* and the trunkless Raphia, which forms tangled thickets. All these plants, as well as the Bombax *(Eriodendron anfractuosum)*, though the latter least, endure the brackish water, but grow quite as well where the water saturating the soil is fresh. On banks which are not reached by the high water, the Bombax rises to a respectable height, and can be seen from a great distance overtopping all the associated plants. This tree throws out strong buttresses which reach up to one-third of the height of the trunk, protecting it from fracture to which its tender wood would be exposed as well as from being uprooted. The above mentioned palm trees and Pandanus form the foreground to the forest of tall trees which covers the highlands of the interior. In this zone the mangrove is replaced in the shallow water by a species of papyrus which sometimes covers large tracts. In time of flood, matted masses of it many rods square are lifted from their anchorage and carried even into the ocean, where they often surprise and mislead navigators.

It is quite beyond my power to fitly describe the forests of the interior, for here stand in a motley mixture the Scitamnaceæ, the Malvaceæ, the Orchidaceæ, Euphorbiaceæ, the Araceæ, the Bombaceæ, etc. To disentangle this confusion would require a first rate botanist. No writer can give a just description of a primitive tropical forest; it is too grand and diversified; but with all its exterior splendor and beauty, it is a deceitful and dangerous thing. Woe to the inexperienced man who essays to penetrate into its interior; he soon becomes involved in a chaos of roots, of interlacing lianas, of fallen trunks, covered with a tangled growth of thorny underbrush, all growing from a dank and swampy soil. Here he breathes a stagnant, musty, greenhouse air, which depresses the spirits and deadens the energies. Added to this there is a deep gloomy silence which broods over this place of most luxuriant growth and rapid decay. Although these mysterious shadows hide an active and varied animal life, the ear is seldom struck by a sound of any kind. Only now and then the falling of a fruit or a dry branch breaks the oppressive stillness. Early in the morning and in the short evening twilight of the tropics, some birds are heard to herald the advent or departure of the day. Such a forest is a subject of unending study, and only he whom nature has endowed with peculiar tastes and acute senses can, with use and experience, become familiar with its varied constituents, its changing phases and its silent language. Woe to the novice who without guide wanders into its recesses, where death lurks for him. In most cases he is soon hopelessly lost, and when weary and despairing he throws himself on the ground to rest, swarms of ants and other insects soon sting him into movement again. Almost no wholesome food is attainable in these forest depths, and should the traveler not die of starvation, or fall a victim to violent, acute fever, the poisonous atmosphere, slowly acting on the system, paralyzes the digestion, corrupts the blood, and produces irritating eruptions of the skin, and frequently malignant ulcers. Such is the primitive forest on the alluvial bottoms of the rivers of tropical Africa. It has been represented as a paradise, and poetical descriptions, drawn from the imagination, have inspired in many, a longing desire to penetrate their mysteries. One must, however, do as I have done, wander lost and alone for days together, enduring terrible suffering and constant fear of death before he can form for himself a true image of the real tropical primeval forest.

Among the errors current in regard to the tropical forest, is the common impression that they are full of dangers from the wild animals which inhabit them. Such dangers are, however, for the most part imaginary. Far up on the highlands of the interior, away from the rivers, the atmosphere is pure, and animal life abounds, but there the forest is, for the most part, replaced by savannahs. These, with a rolling surface covered with luxuriant grass, here and there set with picturesque groves, resemble great deer parks, in which herds of elephants, buffaloes and antelopes of many species find abundant food. In the country about the Gaboon the mammalian fauna is, on the contrary, very poor in species, but it has the crowning interest that it includes the great anthromorphous apes, *Troglodytes gorilla* and *Troglodytes niger.* Here are none of the large antelopes, giraffes, gnus, zebras, quaggas, rhinoceroses, gazelles, lions, ostriches, etc., which abound in the interior. The leopard is common, the black variety is occasionally seen, but rare. Of wild hogs there are a few bands of Phacochœrus, and in greater number, *Sus penicillatus*, the former with gigantic tusks, the other with long face, tufted ears and tail. Only a few jackals and hyenas are found, and during my six years of roaming, I have shot but one of the latter; it was the large spotted hyena. The *Mystomys velox*, which belongs to the Insectivora, is found, though rarely, along the banks and shores of rivers or lakes, hunting after crabs and fishes. From similar glands it diffuses a musky smell like that of the civet. Otters occur, also the African porcupine, and an animal resembling the great ant-eater, *Myrmecophaga jubata ;* the latter is found only in South America, but a native offered to sell me at a trading post in the interior, a large and fresh skin with the long haired broom-like tail, remarkably like this species.

Beside the gorilla and chimpanzee, the monkey tribe is represented by the mandrill with the blue face, and by the long tailed dog-faced baboons, as also the black four-fingered very timid and nimble *Colobus niger, Cercopithecus cephus, C. erxlebeni, C. ethiops. C. erythropyga*, as asserted by my friend Dr. Pecknel.

In the rivers and lakes there are hippopotami which sometimes, but rarely, go down to and into the ocean. The manatee, being much hunted for its delicious flesh by the natives, who are extremely skillful in throwing the harpoon, is continually decreasing in numbers, and will probably suffer the fate of her sister of the salt water.

There are here two kinds of crocodiles, *C. tetraspes* and *C. cataphractus;* the latter resembles the East Indian Gavial in size and the form of its muzzle, while the former is more like the caiman; I have never heard that any one has here been injured by them, and yet both species, in the Camaroon near the Congo, make victims of many of the natives.

A leather-backed turtle, *Aspidonectes aspilus*, is found here, and the waters abound in fish, but they seem to me far inferior to our common European species. This may, however, be in part due to the very rude manner in which they are prepared for the table.

Of serpents there exist the following kinds: first, the slender, pointed-headed, harmless tree snakes; second, various sorts of water snakes, of which the names are unknown to me; third, we find here the largest of serpents, the python. Exaggerated reports of the size, strength and voracity of these snakes are current in the mouths of the people, and even yet in scientific books. I have frequently met with them; I even once stepped on the tail of a python eighteen feet long, which was lying stretched at full length on the ground in the torpor of digestion. To be sure it took it in bad part, but fortunately I did not give it time to fully declare its intentions, for a hasty shot of my gun laid it writhing at my feet.

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PUEBLO POTTERY.

BY EDWIN A. BARBER.

THE ancient *Pueblos* were the only aboriginal people within the limits of the United States who possessed the art of glazing their pottery. Their descendants, the Pueblo and Moqui Indians of New Mexico and Arizona, are the only tribes which manufactured a lustred ware, that remained, until a year or so ago, comparatively uninfluenced by civilization. The art may have deteriorated in some respects during the past century, yet some of the original forms of vessels have been preserved from a remote antiquity. Many of the modern productions are almost identical in shape with specimens which have been found in ancient graves and amongst the ruined buildings in the valleys of the Rio San Juan and the Rio Grande del Norte; yet the influence of Caucasian refinement has, to a certain extent, begun to show itself in the imitation of objects of recent introduction, and we may safely conclude that aboriginal ceramic art will have disappeared forever in this section before the rapid march of civilization, within the space of a few more years. The railroad which has, during the last few months, penetrated into hitherto isolated sections of the West, inhabited by the modern Pueblo tribes, has carried away the greater portion of the native household wares, and the limited amount of pottery which is still being produced, is made in a hasty and superficial manner for sale to curiosity hunters. It will not be long ere metal utensils will supersede the fictile vessels of the natives, and specimens of earthen-ware which were made a few years ago will increase in rarity and value, which will be enhanced as the art becomes entirely obsolete.

The Tenth Annual Report of the United States Geological and Geographical Survey of the Territories, in charge of Dr. F. V. Hayden, containing several full-page lithographic plates of Pueblo pottery, has drawn considerable attention to this interesting ware. A large number of examples sent to me at various times during the past two years, however, shows more satisfactorily the great diversity of form which eminently characterizes the modern productions. Pottery is still made in the majority of the twenty Pueblo towns of New Mexico and the seven Moqui villages of Arizona. The ware produced in the different pueblos varies considerably, however, in quality and style. That made in Zuñi is probably most prolific in animal forms, whilst some of the finest workmanship is displayed in specimens fashioned at the pueblos of Acoma and Cochite. Water bottles made in imitation of birds, such as hawks and owls, are common at Zuñi, while domesticated fowls, such as ducks and hens, are favorite representations at Laguna and Jemez. Vessels shaped after models of mammals are not so numerous in any of the Pueblo villages, but there are not wanting specimens representing rams, goats, sheep, bears, cats, dogs and even a few in imitation of the human form. Indeed the Pueblo potters seem to have copied in clay every object which was familiar to them, and their pottery seems to have surpassed the ancient Peruvian *huacas* in the diversity of form. Specimens made especially for the eastern market, consist of cream pitchers, cups and saucers, miniature boats, figurines and imitations of an endless variety of objects of European manufacture, but these are comparatively worthless as examples of aboriginal art. I am indebted to the Rev. John Menaul, of Laguna, Dr. T. F. Ealy, of

Zuñi, and Dr. J. M. Shields, of Jemez, New Mexico, for a large number of characteristic and interesting specimens of modern ware from several of the Pueblo villages. Some of these examples have been in constant use as household utensils for a score of years, and represent the Indian art in its original purity. These vessels vary from three inches to two feet in diameter, the commonest form being a sphere surmounted by a short, broad cylindrical mouth. One of the finer specimens is an *olla* or meal bowl from Laguna, thirteen inches in diameter and eight in height, the body of which is ornamented with geometrical designs and conventional bird-shaped figures, while the shoulder or expanded neck is decorated with paintings of the elk or deer. This animal fig-

FIG. 1.—Water vessel from Jemez.

ures largely on much of the Pueblo pottery, and is often found on the Laguna jars. It is characterized by an exceedingly large head, thin small body and attenuated legs, with a passage extending from the mouth to the heart, which is usually triangular. The latter is generally colored red, though sometimes brown or black. A particularly interesting pot, or *teneha*, as it is called, possessing a capacity of three or four gallons, had been in use in the tribe for upwards of twenty years. Its value consists in the peculiarity of its ornamentation, being covered with paintings of serpents and conventional devices. It is difficult now to procure such pieces with representations of snakes, frogs, the sun and moon, as, according to Mr. Menaul, the priests monopolize these symbols and discourage the people from employing them. In olden times all of the paintings on their pottery possessed some significance. *Tenehas* are made of all sizes, varying from specimens an inch in diameter to those that will hold twenty or thirty gallons. The majority of the larger vessels possess concave bottoms for steadying on the head in carrying water from the well.

FIG. 2.—Water vessel (Elk) from Laguña.

A common form is the canteen-shaped vessel, being made, in some localities, spherical, with a small bottle mouth. In the Moqui towns these are flattened on one side so as to be adapted for carrying upon the back. They are supported by woolen bands which are passed through the vertical ear-shaped handles and over the forehead of the water bearer. A large proportion of the imitative forms represent birds, and are designed for household ornaments or for carrying water on journeys. A characteristic feature in the bird vessels of Laguna is a broad, short, ascending tail with a perforation for suspension when not in use. One of these vessels, which I have in my possession, is a water bottle or duck, the only opening passing through the bill. This specimen measures six and a half inches in length, and is decorated in brown, buff and red colors on a pure white ground. Another example represents a sitting hen, the body being inflated and almost spherical, surmounted by a very small head with beak curving upward. The

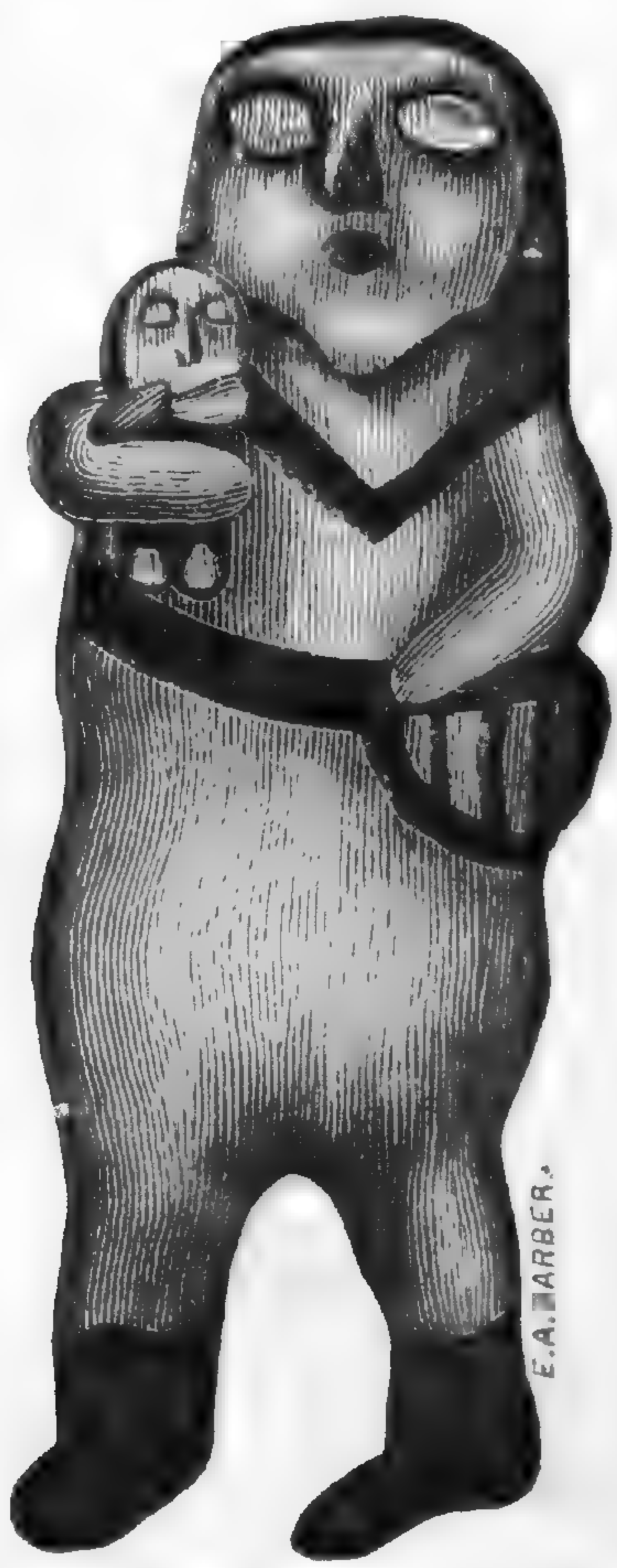

FIG. 3.—Water bottle from Laguna.

orifice is in the top of the cranium. The oldest bird-shaped vessel in the collection is represented in figure 1, and is a fine sample of Jemez workmanship. It is six inches long, the opening being in the head. From the animal forms I have selected a specimen probably intended to represent the deer. The original is twelve inches from nose to tail, with an aperture just back of the ears (figure 2). In addition to the ordinary colors the back is decorated with three triangular patches of bright green paint, which is rare in Pueblo pottery, and has, without doubt, been recently introduced by traders. Specimens from Zia are generally of ruder workmanship, but present the same characteristics as those from the other towns. A large basin from Cochite, twenty inches in diameter, used for mixing bread in, is the finest example of Pueblo ware I have ever seen; the exterior surface is decorated with geometrical designs, while the interior is elaborately and profusely ornamented with animal figures representing elk, deer and wild turkeys, in black. The clay which composes the specimen is of a very fine, compact texture, and is covered with a luster closely resembling that seen upon many of the ancient Grecian urns.

As has been previously stated, vessels are now rarely made in imitation of the human form, and ancient pieces of this shape have never been found. Figure 3 illustrates a modern water bottle, six and a quarter inches in height, from Laguna. It represents a woman carrying an infant. Attached to her left side is a basket or bag in which her hand is thrust. The mouth of the vessel is in the back of the head. It would be tedious to extend our descriptions of modern forms. Suffice it to say that vessels have been molded into every shape that fancy could suggest or ingenuity devise. For the greater part the women are the potters, and their delicacy of touch and keen perception of beauty, enable them to produce many things which are worthy of a place with other ornaments in our cultivated homes.

The clay used in the manufacture of the Laguna pottery is of a dark-slate color, and exceedingly compact, oftentimes approaching soft rock in texture. It occurs in seams or veins in the *mesa* walls. The Indians in order to procure a good quality usually dig into the rock for some distance. There are many grades of this clay, and a variety of colors, the best sorts naturally producing the finer wares. It is prepared for use by first soaking in water for two or three days, when it becomes plastic and easily worked. It is then kneaded with the hands and all the hard lumps extracted, after which it is worked with the feet on a large flat stone, until it resembles a mass of dark colored wax. Old potsherds are also ground up and mixed with the clay in making new vessels. From this paste vessels of various forms are molded and set aside to dry.

The decoration consists of black, brown, red or buff designs on a white or cream-colored ground. The clay used for the ground is a superior quality of kaolin. After being finely powdered, it is mixed with water and agitated, and is then poured from one vessel to another until the gritty substances are entirely removed. This coating, when of the consistency of ordinary lead paint, which it greatly resembles, is then applied to the dried clay vessels, which are in the "biscuit" state, by means of a stick, until the surfaces are entirely covered. "The lustre or glaze," remarks Mr. Menaul, "is given them when the white paint is put on, by rubbing and polishing them with a small, very smooth, flinty stone, such as you find on the sea beach. The paint, being made of a kind of pumice-stone, smooths off as if it had oil in it."

The brown or black pigment is made from a red oxide of iron, and is prepared in the same way as the white clay. Before using this in ornamenting the vessels, in order to prevent its rubbing off, it is mixed with the residue of two plants, obtained by boiling together for a long time until of the required consistency, when it is allowed to cool, and becomes perfectly hard and black. The substance formed by this combination is then applied to the white surfaces of the vessels to be decorated, by means of a brush made from a wisp cut from the surface of a corn-stalk, the designs being generally drawn without first being traced. A yellowish clay or stone which is treated in the same manner as the white, changes to a brilliant red color during the process of burning. The clay used to produce a yellow color is pink, whilst that for drab is of a grayish hue.

After the molding and decorating processes have been completed, the vessels are elevated on stones, usually in the open air, and the dried manure of goats is placed below, around and above them. This is considered the best fuel, producing a very hot, even fire of two or three hours' duration. Through the burning process the vessels are closely watched, so that no portion of them is allowed to become exposed to the atmosphere.

The Pueblo potter works very slowly, and occupies considerable time in molding and beautifying her wares. When at work she kneels upon the ground or floor of her dwelling and bending over the unfinished vessel, gradually imparts to it a symmetry of form by repeatedly going over it with moistened fingers.

The resident missionary at Zuñi, Rev. T. F. Ealy, M.D., writes me in regard to the inhabitants of that town, " old and young try their hand at the art, making objects of all descriptions. When they wish to make anything of mud very carefully, they use the lips to wet the mud and to smooth it, and, I suppose, as a test of its quality. Of course the clay is gotten in different localities—one kind out of one *mesa*, another out of another, according as it is white, blue or red clay." The process as further described by Mr. Ealy is the same as that employed by the Laguna Indians.

Dr. J. V. Lauderdale, now stationed at Mt. Vernon, Alabama, but formerly post surgeon at Fort Wingate, informs me that " Indian women make fancy pottery as other women in civilized life make fancy needlework. They work at it in intervals of more practical labor, and they ornament it as they feel disposed to do at the time. No complete collection of their work can be made at one visit. It is necessary to make repeated visits to get a fair

FIG. 4.—Ancient Pueblo Dish.

collection of their art in pottery. I resided near their village (Zuñi) for four years, and every time I visited the pueblo, I saw something new or a modification of what I had seen before." Mr. F. H. Cushing and Mr. James Stevenson, of the Smithsonian Institution, in 1879 collected at this place upwards of two thousand specimens of pottery, ancient and modern, of which few, if any, were duplicates.

Through the kindness of Mr. Menaul I have been so fortunate as to secure several valuable pieces of prehistoric Pueblo pottery. Figure 4 represents a rectangular dish seven and a half inches in length and four and a half in breadth, with a painting of a bear on either side. It is somewhat similar in form to the salt vessels now made by the Moqui Indians of Arizona. It was found in the ruins of an ancient building about twenty miles north-east of Laguna. The remains are so old that none of the modern Indians know anything about them or their former occupants. Mr. Menaul informs me that in this locality the ruined houses possessed underground vaults for storehouses, which the tribes now farming the

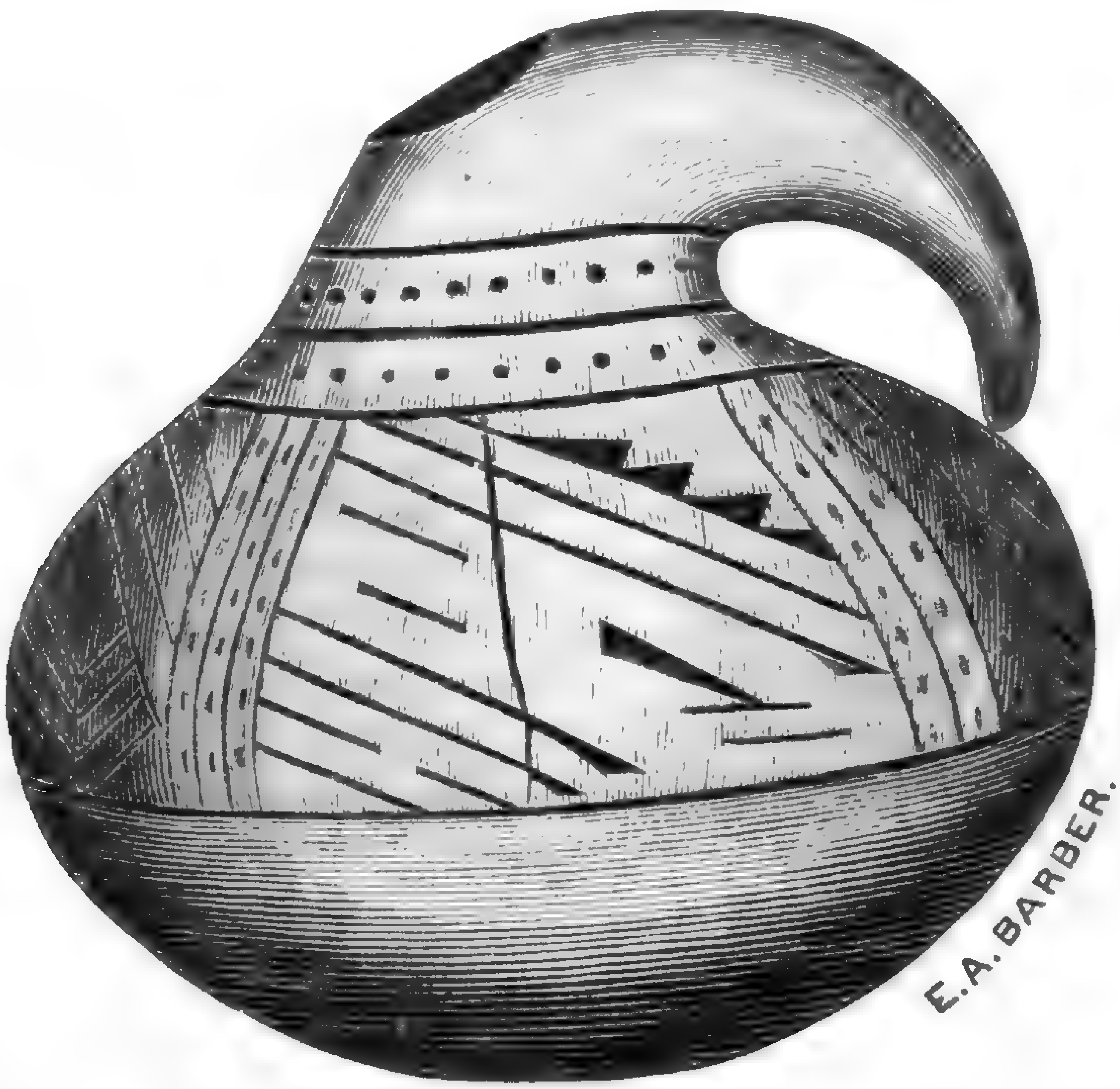

FIG. 5.—Ancient Pueblo Jar.

land do not construct. Specimens of the older pottery, possessing animal decorations, are exceedingly rare. Figure 5 is a copy of another antique vessel from the same place; it measures six inches in height, and is a perfect imitation of a gourd; the surface is very much weather-worn, and in some places the ornamentation is entirely obliterated. The small, circular orifice is situated on the upper portion of the stem or handle. Another ancient vessel from New Mexico, five inches in diameter, so old that the ornamentation can scarcely be traced, closely resembles in form a specimen from Utah in the collection of Dr. Palmer and figured in Hayden's Report for 1876, in Pl. XLV, Fig. 12. Two other specimens, from an ancient ruin in New Mexico, now known as *Pueblo Nunishe*, are of a shape similar to the modern Zuñian clay basket figured in Pl. LXIX, in the same report. These two ancient specimens are decorated both inside and out with paintings representing tadpoles, dragon-flies and turtles, the lesser divinities of water, and two animals which were probably intended to portray the squirrel (possibly skunk) and porcupine, both of which possess the characteristic passage connecting the mouth with the heart. The older pieces described are of the same character as the ancient pottery figured by Dr. Hayden. They represent the ceramic art of past centuries, when almost the entire territory now included in Colorado, Utah, New Mexico and Arizona was thickly peopled by a semi-civilized race who were proficient in many of the useful arts and surpassed all of the other North American peoples in the art of making pottery.[1]

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RECENT LITERATURE.

UNDERWOOD'S NATIVE FERNS.[2]—In the preface to this little book of 116 pages, the author states that its design "is to furnish to those desiring a better understanding of ferns, the means of gaining a knowledge of their structure and life, and of readily determining the species growing spontaneously in North America north of the Mexican boundary." The work is divided into two parts, the first treating successively of—The haunts, habits and distribution of ferns; Morphology of the growing fern; Fructification in ferns; Germination of fern spores; Fern structure; Classification and nomenclature of ferns; How to study ferns; A little fern literature. The second part is devoted to a systematic description of all our species. The treatment of the topics taken up in the first part is good, and well calculated to prepare the learner (for in the prospectus the book is called "a manual for self instruction") for the study and determination of species. Enough is said of the growth of the prothallium, the sexual organs, the development of the young fernlet, and the tissues of the stems and leaves of the mature plant, to make many a beginner long for a compound microscope. Good directions and forms are given for the analysis and determination of any species, much as is done for flowering plants in the well known chapters in Gray's "Lessons."

The systematic part is provided with a good synopsis of the tribes and genera, and also an artificial key to genera. The arrangement is essentially the same as that in Eaton's "Ferns of North America." The disposition of the species is, within narrow limits, original, the intention evidently being to render identification of species less difficult. The inevitable glossary of technical terms (a very good one, by the way) was perhaps necessary, inasmuch as the book is largely designed for the use of amateurs and beginners, but is it not about time that the writers of books considered the advisability of explaining the meaning

[1] For article on the ancient Pueblo pottery by the author of this paper, see AMERICAN NATURALIST for August, 1876.

[2] *Our Native Ferns and how to study them, with Synoptical Descriptions of the North American species.* By LUCIEN M. UNDERWOOD.

of technical terms in the proper places in the text. Every reader or student should be expected to possess and exercise a memory of sufficient strength to enable him to keep in mind the meaning of the terms used and explained in the text. A glossary which merely re-describes or re-defines is a standing temptation to slovenly reading or study, and in the opinion of the writer, ought never to find a place in ordinary text-books designed for students.

The mechanical execution of the book, in the printing and the binding, is neat, and the typographical errors are notably rare. Professor Underwood deserves and will receive the thanks of the many fern-lovers in the country for giving us this book.—*C. E. B.*

KENT'S MANUAL OF THE INFUSORIA.[1]—This will, when completed, be the only available manual of the Infusoria in the English language, the old one by Prichard being superannuated, including as it does diatoms, desmids and Protozoa of all classes. We have looked forward with much interest to the appearance of Mr. Kent's work, and owe to the kindness of a friend an opportunity of looking over three parts which have already been published. It is a much more valuable, extensive and important work than we expected to find, and we can recommend it to microscopists and to the general student as in every way excellent, both in its scientific execution, its fullness of detail, its elaborate and comprehensive introductory portions, which will be read with much interest and profit, and the variety and excellence of its illustrations, the latter of course being an essential feature of such a work.

The first chapter gives the general history of the Infusoria from the time of their discovery, by Leuwenhoek, in 1675, to the year 1880. In the second chapter the sub-kingdom Protozoa is discussed in a way calculated to bring out clearly the relations of the Infusoria to the other classes. Mr. Kent does not regard the Gregarinidæ as entitled to constitute a distinct class of Protozoa, but rather as a "degraded group of the ordinary Rhizopoda most nearly allied to the Amoebina, which exhibit a like modification of structure with relation to the latter as is presented by the Opalinidæ with respect to the ordinary Ciliata." He divides the Protozoa, somewhat unnecessarily we think, according to the degree of differentiation of the ingestive area or mouth, into four sections, naming them as follows: *Pantostomata* (Rhizopoda and a part of the Flagellata); *Discostomata* (the sponges), *Eustomata* (the higher Flagellata and the Ciliata), and (4) the *Polystomata* (including the Tentaculifera alone). We think this sub-division is unnecessary and the nomenclature superfluous, though well calcu-

[1] *A Manual of the Infusoria:* including a description of all known Flagellate, Ciliate, and Tentaculiferous Protozoa, British and foreign, and an account of the Organization and Affinities of the Sponges. By W. SAVILLE KENT, F. L. S., etc. London, David Bogue, 1880. Parts I to III, each 10s. 6d. 8°.

lated to call attention to the successive steps in the differentiation in the Protozoa of a "mouth" or ingestive area.

The author's system does not recognize the *Monera* of Haeckel, and he rather dogmatically relegates them to the Rhizopods, not awaiting further discoveries as to the presence or absence of a nucleus, dismissing them with the remark that since the Foraminifera, included by Haeckel in the group Monera, have been proved to possess a nucleus, "A similar demonstration of the possession of nucleolar structures in the few remaining organisms relegated to this group will not improbably result from their further careful examination, with the assistance of the special treatment resorted to in the case of the Foraminifera. Finally, it is altogether questionable whether the presence or absence of a nucleus or endoplast can be accepted as furnishing a distinct and reliable character even for specific diagnosis. This structure, as shown at greater length in the chapter devoted to the organization of the Infusoria, is evidently in many instances an accompaniment only of the matured and reproductive phase."

Mr. Kent also, and here we think with excellent reason, dismisses as "entirely unnecessary and untenable," the *Protista*, a kingdom set up by Haeckel and including all organisms supposed to be intermediate between the plants and animals and comprising the lowest representatives of both; although our author is clearly alive to "the difficulty of indicating a clear line of demarkation that shall arbitrarily separate certain unicellular cryptogamic plants or Protophyta from the unicellular animals or Protozoa." Mr. Kent claims, however, as the result of close investigation on his part upon Volvox and Protococcus and certain allies of these forms, that he failed to find any periodically contracting vesicles, and he thinks that the absence of a contractile vesicle is characteristic of these lowest plants.

Our author regards the Myxomycetes or *Mycetozoa* as belonging to the animal kingdom, remarking that "the evidence most recently and independently eliminated by L. Cienkowski and Dr. A. de Bary, concerning the structure and life-history of this most remarkable group, establishes, however, beyond question their purely animal nature. The Mycetozoa, in common with all ordinary representatives of the Protozoa, originate from minute sporaloid bodies which escape from the spore case as monadiform animalcules having a soft, plastic body-substance, a single terminal flagellum, contractile vesicle and endoplast or nucleus, being thus in no way distinguishable from the typical representatives of the ordinary Flagellata-Pantostomata, as met with in the genus Monas." He then farther recapitulates their later developmental stages, and gives good reasons for their Protozoan nature.

Another singular and doubtful group, the Labyrinthulida, are likewise referred by Mr. Kent, to a position in the Protozoa midway between the Foraminifera and the Myxomycetes. The sponges are by Mr. Kent regarded as forming simply a single order (Spongida) of Flagellate Infusoria and standing next to his order of Choano-Flagellata, represented by the stalked, collared Codosiga, Salpingœca, and Protospongia.

The structure of the Infusoria proper, are then described with much clearness and detail, as well as their reproductive phenomena, the author devoting considerable space to the modern view of Balbiani and the opposing one of Engelmann and Bütschli as to the nature of reproduction in the Infusoria. While not accepting Balbiani's views, afterwards confirmed by Kölliker, Stein, Claparède and Lachmann, that the nucleus is an ovary and the nucleolus is a testis, and that certain Infusoria reproduce by eggs fertilized by seminal particles analogous to those of the higher animals, the author insists that germs or embryos are in several forms produced by the subdivision of the nucleus. He also maintains that the process of conjugation, especially in the Vorticellidæ, where it is complete and permanent, and so far as is known in all the Flagellata, the larger individual corresponds to the female element, or egg, and the smaller to the male element, or spermatozoön.

Sections follow on the affinities of the Infusoria to the higher animals, their distribution, the modes of preserving them for study, the methods of investigation, while the fourth chapter is devoted to a discussion of the doctrine of spontaneous generation.

The succeeding chapter on the nature and affinities of the sponges comprises a long discussion of the question as to the position of the sponges in the animal kingdom, with the result of considering them as an order of Flagellata Infusoria, allied to Codosiga, etc., a view first proposed by Professor H. James Clark, of this country. The historical treatment of the subject is just to other observers and moderate and original in the views presented. Mr. Kent believes with Clark that the sponges are colonies of collared flagellate infusoria, and considers that the Protospongia is the connecting link between the genuine Flagellata with a collar and the sponges. He considers that the fact that the collared cells lining the ampullaceous sacs of the sponge have a contractile vesicle like genuine Infusoria, is a powerful argument in favor of their Flagellate affinities. The strongest argument against the Protozoan nature of sponges, is the fact that they are now generally recognized to develop from true eggs, which are fertilized by genuine spermatozoa, and that the eggs undergo segmentation, passing through a condition at least analogous, if not homologous with the morula and gastrula, or at least planula of the Cœlenterates. We have not space to give the author's arguments, even in a condensed form, and would only state that they are well put and cogent, while at the same time, throwing out Haeckel's work, whose merits Mr. Kent is disposed we think to somewhat underrate, and confining ourselves to the result of the elaborate and careful observations of Melschnikoff, F. E. Schultze and

Barrois, we fail to be convinced that the sponge is not a many-celled animal, reproducing by eggs and passing through stages comparable with the mulberry and planula stages of the jelly fishes. If the reader, after studying the works of the above named authors, will then read the admirable summary of the embryology of sponges in Balfour's Comparative Embryology, we think that he will be inclined neither to accept the view that the sponges are on the one hand genuine Protozoa, nor on the other genuine Metazoa. In this connection the suggestions of Balfour as to the Protozoan affinities of the sponges will have much weight. The arguments of Mr. Kent have made a strong impression on us, and have led us, while believing that the sponges represent a distinct subkingdom, to look with more favor than heretofore on the close relations of the sponges to the Protozoa. Indeed, we should feel strongly inclined to the view that the sponges belonged to a category or super-branch, as we might consider it, intermediate between the *Protozoa* and *Metazoa*, to which the term *Spongozoa*, already used, might well be applied. We do not see why the so-called eggs of sponges are not such, even if they are originally amœba-like forms, that of Hydra being at one time amœbiform. Kent has studied more closely than any one else the so-called spermatozoa of the sponges, and concludes that they simply correspond to the spores which originate from the collared Flagellata, but we should hazard the opinion that his facts may be interpreted in an opposite way, and judging from his drawings do not see why his cells (see Pl. x, fig. 11, b on upper edge of figure) containing spores do not correspond to the mother-cells inclosing the incipient spermatozoa of higher forms of Metazoa. The lining cells of the ampullaceous sacs, even if they are collared, appear to us to fairly represent the epithelial tissue of hydra and higher animals, though forming a less homogeneous, differentiated tissue; why should not, as in Metazoa, certain of the epithelial cells become specialized in the manner described by Kent, and form egg-cells and sperm-cells? The striking individuality of the sponge-cells and their power of ingesting living algæ and other minute organisms have lately been shown to exist by different observers in different Cœlenterates. We owe to Messrs. James Clark and Saville Kent, we are bound to say, strong arguments for the Protozoan affinities of the sponges, but when we balance their observations and conclusions with those of Haeckel, Metschnikoff, Schultze and Barrois, we cannot resist the impression that the sponges should stand as an independent branch half way between the Protozoa and Cœlenterates or Metazoa in general. They are the connecting links between the unicellular and the many-celled animals; between those without tissues and germ-layers, and those with genuine tissues and definite cell-layers. We may fail to apply the terms ectoderm, mesoderm and endoderm to the but partially differentiated tissues of the sponges, we may deny them a true morula and gastrula condition, but still they will be found to wonderfully anticipate the Metazoa in these respects, and will thus serve as transition forms, connecting at many points the Protozoa and Metazoa, and showing that the distinction involved by these terms is more or less artificial. By a study of the sponges we can see how it has been possible for tissues and germ layers to have had an origin. In short, to regard the sponge as Protozoa, seems to us as extreme as to consider them as forming a division of Cœlenterates.

The systematic part of Mr. Kent's work is well done, the generic and specific characters are given in much detail. The work is evidently the result of much labor and skill, in microscopic observation and delineation, and will, we feel sure, incite many others to study these infinitesimal forms.

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GENERAL NOTES.

BOTANY.[1]

A Botanist's Trip to "The Aroostook."—I find by reading the Naturalist, that all matters of botanical interest are welcomed by its editors, and full of the enthusiasm of all lovers of nature, I venture to send to its readers a brief account of my life last summer in Aroostook county, Maine. I went there for the purpose of gathering "wild flowers," hoping to add a few new species to the large number which I had already collected in various counties in the State. I arrived at Fort Fairfield July 6th, and to my delight found the banks of the Aroostook river abounding in work for my brush. I remained there six weeks, and enriched my portfolio with sketches of the following plants, viz: *Tofieldia glutinosa*, *Allium Schœnoprasum*, *Parnassia Caroliniana*, *Triglochin palustre*, *Castilleia pallida*, *Rosa blanda*, *Anemone Pennsylvanica*, *Campanula rotundifolia* var. *linifolia*, *Ascyrum stans*, *Tanacetum Huronense*, *Hedysarum boreale* and *Astragalus alpinus*. (The three latter are reported by Professor Goodale and Mr. C. G. Pringle.) From Fort Fairfield I went to Caribou and Presque Isle, still following the river. In these places I gathered *Oxytropis campestris* (also reported by G. L. G.), *Nabalus racemosus*, *Lobelia Kalmii*, *Polygala Senega*, besides many more plants with which the banks abound. And in a cold deep swamp at Caribou, which they call the "Bog on the Barren," I gathered large quantities of *Valeriana sylvatica*, *Galium trifidum* vars. *pusillum* and *tinctorium*, *Epilobium molle*, and a few specimens of *Microstylis monophyllos* and *M. ophioglossoides*. Orchids abound in these wet, inaccessible places, especially *Cypripedium spectabile*, *Habenaria dilatata* and *H. hyperborea*. I found the first named in such masses and so high that it hindered our progress considerably. In an equally cold bog at Presque Isle, I gathered *Ribes rubrum*, *Lonicera oblongifolia* and *Rhamnus alnifolius*. In "a fallow" at Caribou, occurred an abnormal form of *Viola canina* (Aug.); I gathered it because it was so late in the season and the blossoms were so pretty, not discovering at the time that they were spurless, but I have shown them to four botanists and they agree that they are *V. canina*, and are both spurless and beardless. In the same wild and fascinating place I found large numbers of the delicate fern named *Cystopteris bulbifera*; it was so woven into the underbrush that the longest specimens which I was able to procure in a perfect state are but two feet in length, but they grew much longer. It was warm and

[1] Edited by Prof. C. E. Bessey, Ames, Iowa.

damp there, and nestled beneath them were plants of *Asarum Canadense*. The same morning I stood to my eyes (five feet) in masses of *Eupatorium ageratoides*. It is a coarse but very showy plant with large corymbs of white flowers. It is abundant in Northern Maine. I mention the height of this plant to give some idea of the rank growth of the "weeds" in this county, and I will state here that I saw *Verbascum Thapsus* ten feet high, also *Lactuca Canadensis*. Go and see! I will not tell my aster story here, but will wait till we visit the place where I found it. *Sedum Telephium* is a very troublesome weed in some parts of the county, whole acres of land being overrun with it, and I am told that it has been there as long as the oldest inhabitants can remember. The only new plant which I found in the Swedish colony was *Ribes lacustre*. In riding from Caribou to Van Buren, a distance of twenty-two miles, the monotony of the wearisome ride was relieved by clumps of *Chenopodium capitatum*. Burdened with its bright red, pulpy fruit, it had sprung up among the charred stumps like a thing of beauty, as it was. At Van Buren we struck the St. John river, but the same plants which I have enumerated above repeated themselves with a few additional ones. Pedicularis, n. sp.? grew three feet high on the bank of the river where the water trickled down its sides. Among other plants I gathered *Galeopsis ladanum* and *Solidago virga-aurea*, *S. thyrsoidea*, and *S. bicolor* var. *concolor*. I did not see the typical form in this latitude, which by no means proves that it is not found there. *Solidago squarrosa* is abundant everywhere, and grows so rank that its only beauty lies in its gay color. Now for my large story. I measured *Aster puniceus* six feet and a-half high (Gray allows six feet), and the stem seven-eighths of an inch in diameter; it stood in a deep, narrow, damp ravine, and many of the branches were three feet long. It looked like a huge bouquet of purple flowers. The ferns which attracted my attention particularly at this place, were *Botrychium Virginianum* and *B. lunarioides*, vars. *dissectum* and *obliquum*, *Adiantum pedatum* and *Struthiopteris Germanica*. *Halenia deflexa* abounds throughout the county. *Viburnum opulus* was so abundant with its scarlet berries, that it made the landscape gorgeous. In the ride of forty-five miles along the river to Fort Kent, we found nothing new. At Frenchville, where the St. John turns to the south (the highest latitude to be reached in Maine), we looked upon acres of the mammoth stalks of *Solidago squarrosa*. In the two and a-half months which I passed in the county, I noted 208 different plants, and added fifty new ones to my own list. I saw a man in the county who cursed our "high sounding names." Ambitious to possess foreign shade trees, he was indignant to find that *Pirus Americana* and *Ulmus Americana* mean simply "round wood" and "elm," with which his forests abound. It may be worthy of notice that I found *Gaylussacia dumosa* fifty miles from the sea coast.—*K. Furbish.*

Our Species of Cedar Apples.—The curious growths on white cedar, red cedar and juniper, to which the name Cedar Apples has been given, have recently been carefully studied by Dr. Farlow. The results of his studies are published in the Memoirs of the Boston Society of Natural History, covering thirty-eight quarto pages, and accompanied by two plates.[1] This important contribution is the first of a series of papers upon the Uredineæ, which Dr. Farlow hopes to publish soon. The popular interest in these plants is sufficient reason for giving space here for a synopsis of the paper.

All the cedar apples are now considered to be species of the genus Gymnosporangium, belonging to the order Uredineæ, and nearly related to the rusts (Puccinia, Uromyces, Phragmidium, etc.), from which they differ mainly by having their teleutospores imbedded in a mass of jelly. The life history of all our species is involved in some obscurity, which the careful and prolonged observations and experiments of the learned author have not been able to dispel. Œrsted, De Bary and others have succeeded in showing that the European species of Gymnosporangium have the same relation to certain species of the old genus Rœstelia, as subsists between the teleutosporic stage (Puccinia) of the grain rust, and the cluster cup of the barberry (Æcidium). In other words, it has been shown that certain supposed species of Rœstelia are but the æcidia of certain species of Gymnosporangium. Now as we have several species of Rœstelia in the United States, it may be supposed that a similar relation exists between them and certain of our Gymnosporangia. The most careful experiments have failed to show any such connection, however.

Most cedar apples are perennial, and appear year after year upon the host. The teleutospores, which are mostly two-celled, sometimes several celled, develop in little clusters which expand into columnar or irregular masses (technically called the *sporiferous masses)* when wet, as after a rain. In this expanded state they are very conspicuous, and are often mistaken by the non-scientific for the flowers or the fruits of the trees upon which they grow.

The following generic and specific descriptions are taken without modification from Dr. Farlow's paper; in his paper, however, each description is accompanied with notes upon their synonomy, and copious discussions upon structural peculiarities.

Gymnosporangium De Cand.

Spores yellow or orange-colored, usually two-celled, occasionally one to six-celled, on long hyaline pedicels, imbedded in a mass of jelly which, when moistened, swells into columnar or irregularly expanded masses. Mycelium parasitic in the leaves and branches of different Cupressineæ, producing in them various distortions.

[1] The Gymnosporangia, or Cedar Apples of the United States. By W. G. Farlow.

The genus as here defined includes the species of the old genus Podisoma.

1. *G. Ellisii* Farlow.—Sporiferous masses numerous, scattered, cylindrical, filiform, from one-eighth to a quarter of an inch high; spores dark yellow, linear-fusiform, obtuse, usually three to four-celled, sometimes one to five-celled, 10 to 16 μ. in diameter, 75 to 190 μ. long, average 120 to 150 μ.; pedicels long and slender; promycelia short and much curved, usually one from each cell. Mycelium perennial, distorting the smaller branches. On *Cupressus thyoides.* N. J., Mass.

2. *G. clavariæforme* De Cand.—Sporiferous masses numerous, scattered or aggregated, yellowish-brown when dry, bright yellow when swollen, cylindrical, or slightly compressed, acute or occasionally forked at the apex, from a quarter to half an inch high; spores narrowly lanceolate, those on the outside of the gelatinous masses clavate, two-celled, 13 to 19 μ. broad, by 55 to 90 μ. long; promycelia usually one or two from each cell. Mycelium perennial, causing long fusiform swellings of the branches. On *Juniperus communis.* Maine.

3. *G. macropus* Lk.—Sporiferous masses aggregated in globose tufts, surrounded at the base by a ring formed by the raised epidermis and subepidermal tissue of the host plant, orange-yellow, cylindrical, acuminate, half an inch to an inch long, or at times longer; spores ovate-acute, two-celled, generally constricted at the septum, and with a papilla at the apex, 15 to 20 μ. broad, by 45 to 60 μ. long; promycelia generally four from each cell. Mycelium annual, producing globose or reniform knots in the smaller branches. On *Juniperus Virginiana.* Mass. to S. C. and westward to Wis., Mo. and Colorado.

4. *G. fuscum* De Cand.—Sporiferous masses numerous, generally approximated brownish when dry, dark-orange when swollen, a quarter to half an inch high, compressed-conical or wedge-shaped, upper margin thick, rounded, sometimes notched; spores roundish-ovate, two-celled, frequently constricted at the septum, 38 to 53 μ. long, by 15 to 22 μ. broad; upper cell either nearly hemispherical or obtuse; promycelia generally four from each cell. Mycelium perennial, causing long swellings of the branches. On *Juniperus Virginiana* and *J. communis.* Mass., Md.

5. *G. fuscum* De Cand., var. *globosum* Farlow.—Sporiferous masses densely aggregated, dark-brown when dry, yellowish-orange when swollen, a quarter to half an inch high, compressed-conical or wedge-shaped; spores ovate, sub-acute, 38 to 45 μ. long, by 19 to 21 μ. broad; promycelia usually four. Mycelium perennial, forming globose swellings in the branches. On *Juniperus Virginiana.* Mass. to S. C.

6. *G. biseptatum* Ellis. — Sporiferous masses flattened and brownish when dry, becoming hemispherical or oval and rugose when swollen, and of a light-yellow color, about a quarter of an

inch high; spores linear-oblong, obtuse, two to six-celled, most frequently three or four-celled, 50 to 84 μ. long, by 15 to 20 μ. broad; promycelia one or two from each cell. Mycelium perennial, forming node-like swellings in the branches. On *Cupressus thyoides*. Mass., N. J. On Libocedrus, Calif.

7. *G. clavipes* C. and P.—Sporiferous masses subpyriform or irregularly globose, becoming indefinitely expanded, reddish-yellow when dry, orange when swollen, about a quarter of an inch high; spores broadly ovate, obtuse, two-celled, generally constricted at the septum; pedicels broad, much swollen beneath the spores, 40 to 60 μ. long, by 22 to 38 μ. broad; promycelia usually two or three from a cell, frequently produced from the apex of the cells. Mycelium perennial in the leaves and branches, producing nest-like distortions. On *Juniperus Virginiana*. Mass., N. Y., N. J., Penn., N. C., S. C.

8. *G. conicum* De Cand.—Sporiferous masses subpyriform or indefinitely expanded, orange colored, half an inch high; spores oblong, two-celled, constricted at the septum, 48 to 58 μ. long, by 15 to 18 μ. broad; promycelia either two or four from each cell, given off near the septum. Mycelium perennial, forming long swellings in the branches. On *Juniperus Virginiana*. Mass., N. Y., S. C.

Cohn's Classification of the Thallophytes.—This recent attempt at a satisfactory disposition of the Thallophytes deserves the careful study of botanists. As will be seen, Cohn still holds to the view originally put forth by him in 1872, which discards the old groups Algæ, Fungi and Lichenes. The present arrangement differs from his former attempt in several particulars, the most important of which is the disposition of the orders in two diverging series, the Carposporeæ and Gamosporeæ. Several things strike one as out of place. It is difficult to see, for example, any sufficient reason for placing the Schizosporeæ in the series Carposporeæ. The position of the Myxomycetes is also a curious one; it is only in a purely fanciful way that the plasmodium of the Myxomycetes can be regarded as a colony *(cœnobium)* similar to that of Volvox, Hydrodictyon, etc. The position assigned to the Ustilaginaceæ near Mucoraceæ is, to say the least, questionable. The Entomophthoræ are much more nearly related to the Saprolegniæ (if indeed they are not to be classed with them) than to Piptocephalis and Mucor.

SERIES I.—CARPOSPOREÆ.

This is nearly identical with the group of the same name as defined by Sachs in the fourth edition of his "Lehrbuch." It however includes the Schizosporeæ, and excludes the Characeæ, which are considered as low forms of Bryophyta.

Order 1. Schizosporeæ: (*a*) *Schizophyta.* Families, Chroococcaceæ, Oscillariaceæ, Scytonemaceæ, Nostocaceæ, Rivulariaceæ. (*b*) *Schizomycetes.* Fam. Micrococcaceæ, Bacillaceæ, Cladotrichaceæ, Myconostaceæ.

Order 2. Tetradosporeæ (Florideæ): Fam. Bangiaceæ, Dictyotaceæ, Nemaliaceæ, Lemaneaceæ, Ceramiaceæ, Gigartinaceæ, Sphærococcaceæ, Rhodomelaceæ.

ORDER 3. ASCOSPOREÆ: (*a*) *Gymnocarpi*, Saccharomyces, Ascomyces, Exoascus, Gymnoascus. (*b*) *Æcidiocarpi*, Fam. Uredineæ, Calyciaceæ. (*c*) *Discocarpi*, Fam. Stictideæ, Graphideæ, Hysteriaceæ, Bulgariaceæ, Lecideaceæ, Pezizaceæ, Collemaceæ, Parmeliaceæ, Usneaceæ. (*d*) *Porocarpi*, Fam. Laboulbeniaceæ, Sphæriaceæ, Lichenaeæ, Verrucariaceæ, Pertusariaceæ. (*e*) *Cleistocarpi*, Fam. Erysiphaceæ, Eurotiaceæ, Tuberaceæ.

ORDER 4. BASIDIOSPOREÆ: Fam. Auriculariaceæ, Tremellaceæ, Telephoraceæ, Clavariaceæ, Polyporaceæ, Agaricaceæ, Phallaceæ, Hymenogastraceæ, Lycoperdaceæ, Nidulariaceæ.

SERIES II.—GAMOSPOREÆ.

The single reproductive cells, formed by the sexual union of other cells, provide the main character binding together the groups of plants constituting this series.

ORDER 1. CONJUGATÆ: (*a*) *Zygophyceæ*, Fam. Bacillariaceæ, Desmidiaceæ, Zygnemaceæ. (*b*) *Zygomycetes*, Fam. Entomophthoraceæ, Ustilaginaceæ, Piptocephalideæ, Mucoraceæ.

ORDER 2. SIPHOIDEA: (*a*) *Siphophyceæ*, Fam. Caulerpaceæ, Bryopsideæ, Codiaceæ, Vaucheriaceæ. (*b*) *Siphomycetes*, Fam. Peronosporaceæ, Saprolegniaceæ, Chytridiaceæ.

ORDER 3. CŒNOBIÆ: (*a*) *Cœnophyceæ*, Fam. Protococcaceæ, Palmellaceæ, Valoniaceæ, Volvocaceæ, Hydrodictyaceæ. (*b*) *Cœnomycetes*, Fam. Myxomycetes.

ORDER 4. CONFERVOIDEÆ: (*a*) *Syngametæ*, Fam. Ulvaceæ, Ulotrichaceæ, Cladophoraceæ. (*b*) *Oosporeæ*, Fam. Sphæropleaceæ, Oedogoniaceæ, Coleochætaceæ.

ORDER 5. FUCOIDEÆ: (*a*) *Phæosporeæ*, Fam. Ectocarpeæ, Sphacelariaceæ, Chordariaceæ, Laminariaceæ, Sporochnoideæ. (*b*) *Oosporeæ*, Fam. Fucaceæ.

BOTANICAL NOTES.—The Secretary of the Linnean Society, B. D. Jackson, has recently been directing attention, in the *Journal of Botany*, to some recent tendencies in botanical nomenclature, and among others he deprecates the tendency, in some quarters, to the abandonment of the rather liberal use of initial capital letters in writing specific names, which Linnæus introduced. He regards the usage of Linnæus as authoritative, and cites examples to show that the initial capital letter should be used when the specific name is (1) an old generic name, (2) a native name, (3) a substantive used instead of an adjective, (4) a substantive used in the genitive case, (5) a substantive used adjectively in commemoration. "All other names," he says, "must begin with a small letter, even if derived from places or other genera." This certainly commends itself as conducive to *uniformity*, but were it not that at most it is a matter of but little importance, it might be asked whether even so great a master as Linnæus should be permitted to fix usage for all time.——In the same journal S. L. Moore dissents from Darwin's doctrine of the nature and meaning of cleistogamy, and believes "that cleistogamy is caused by the physiological condition of great fertility without crossing, coexisting with the morphological one of germination of the pollen while still within the anther-cell, or at least before expansion of the perianth. The result of the latter condition is arrest of the floral envelopes, which remain in position until separated or pushed up by the enlarging capsule." He bases this theory upon the well known fact that after fertilization the corolla soon withers.——There is a widespread notion that it requires costly microscopes and a good deal of apparatus to enable one to successfully engage in histological study in botany. The fallacy of this notion is well shown in an article in the April *Botanical Gazette*, by Dr. Rothrock, who describes the apparatus and modes of work in De Bary's laboratory in Strasburg. Hartnack's small upright microscope, without sub-stage or joint, and costing from thirty to forty dollars, are used. The optical parts are, however, of good quality, and furnish a power ranging up to about six hundred diameters. In making sections, razors and pieces of pith are mainly relied upon, expensive section cutters not being used.——Dulau & Co., of London, are to publish immediately an important book, "A Guide to the Literature of Botany," by B. D. Jackson. It includes nearly six thousand more titles than Pritzel's "Thesaurus."——"A Manual for the Preservation of the larger Fungi," by James L. English, is announced as in preparation.——M. C. Cooke has begun the publication of Illustrations of British Fungi, consisting of colored plates of the Hymenomycetes. The parts, issued quarterly, include sixteen octavo plates each.——Professor McBride, of the University of Iowa, has issued a Plant Record for the use of Students, which in some respects is an improvement upon any previously published ones.——J. F. James, in the *Journal of the Cincinnati Society of Natural History*, presents a paper in which he compares the flora of N. E. United States with that of Europe. It is an excellent summary of what is known as to the geographical distribution of plants.——Dr. Gray and Dr. Hooker have finally brought out their long promised report upon the vegetation of the Rocky Mountain region. It is published in Vol. VI of the Bulletins of the U. S. Geol. and Geog. Survey of the Territories. It will be noticed more fully hereafter.——Francis Wolle contributes another of his valuable notes on Fresh-water Algæ, to the April *Torrey Bulletin*.——An interesting list of the plants of Western Dakota and Eastern Montana, by Assistant Surgeon Havard, has just been issued from the Government printing office, as an appendix to the Report of the Chief of Engineers for 1880.

ZOÖLOGY.

MORE ABOUT THAT CAT.—In the February NATURALIST, I narrated some instances of unusual sagacity in our pet cat, "Old Shorty." He died on the 19th of that month, deeply lamented by his friends. He was not only a model of all the virtues consistent with the feline life, but possessed many high and noble traits not supposed to appertain to this species of carnivores. I mentioned his fastidiously neat and tidy habits, which he maintained down to the last day of his life. We once had a pet squirrel which was kept in a cage with the usual revolving wheel. "Shorty" never molested the mischievous rodent unless he happened to escape from the cage, when he was always ready to help capture the scamp. I have often pursued "Chip" fifteen or twenty rods with "Shorty" close at hand and lending me every assistance in his power! On one occasion when the family were all away from the house, "Chip" got out of the cage and escaped through an open window. Returning late in the afternoon, I found him in a plum tree. "Shorty" sat on the ground near by, he had evidently run the squirrel up the tree, and was patiently standing guard—like a master of grand strategy—"waiting for reinforcements." Together we captured the squirrel and returned him to his cage. When "Shorty" was about three years old, we gave him away to a lady friend, who carried him to her house in the county, three miles off, by a very crooked road and after dark. She kept him shut up for three or four days, when he was released. He started at once for home, though he was fully three days in reaching us. We imagined that the sounds of the church and schoolhouse bells in the village enabled him to find his way back. He had to cross a small stream, which would be quite a serious obstacle in the way of a cat, and this, doubtless, made his journey more protracted. But we never gave him away again! He had no fear of any dog he ever met, and in his younger days had the honor of soundly threshing several of them! I could set him upon any stray dog that happened to come upon the premises. He never failed to drive the intruder off, and woe to the dog if he failed to "git out" in a twinkling! Contrary to the prevailing disposition of common cats, he never stole anything! Neither choice beef nor Jersey milk on the pantry shelves ever tempted him to violate the eighth commandment. He was sick at the last about three weeks, as we supposed from some derangement of the liver, though he was fifteen years old. He dearly liked to be talked to all this time, and in return would always purr, though but faintly and with much effort. He sang his last little song to me about ten hours before he died, as I sat holding his poor weary head in my left hand and stroking his rich glossy back. I was telling him how good he had been all his life long, and how sorry I was to see him so sick. But his little song was so faint and low that I had to put my ear close to his mouth to hear it. He was gentle, affectionate and intelligent beyond any domestic animal I ever saw, and his whole life was full of beautiful, pleasant ways. When he finally breathed his last, the old house seemed really deserted and lonesome—though he was "only a cat." We always thought he would deserve a monument, and we feel that in admitting his humble story to its pages, the AMERICAN NATURALIST has given him a proud and enduring one.—*Chas. Aldrich, Webster City, Iowa, March. 1881.*

BIRDS OUT OF PLACE.—The red-wing blackbird *(Agelains phœniceus)* usually leaves this region by the middle of November, though if the weather continues mild, some of them will tarry awhile longer. But late in December I saw perhaps a dozen of them wading in the shallow water just below a mill-dam near my residence. They remained about this place for several days. At the time the ground was covered with snow, and the ice was more than fifteen inches thick on the mill-pond above.

Lately a workman on my farm stated that in January he had seen a robin *(Turdus migratorius.)* where a little spring of water flows out of the bank below the mill-dam. This was deemed a mistake, for the robin always leaves us in autumn and never returns until mild weather in late February or early March. But chancing to pass the same spot yesterday, my attention was attracted by a bird which was hopping over the gravel bed and stopping to pick up something. Going as near as I could without alarming it, I saw at once that it was our own robin redbreast! It seems more singular that it should remain with us when its mates are all away in the sunny South! To-day we are having a regular Iowa "blizzard." The snow would be twenty inches deep if it were not piled in great drifts, and the ice in our little river is at least three and a half feet thick! I visited the spot to-day, but did not find my robin. Several chickadees *(Parus atricapillus)* were hopping about the spring, doubtless in search of food or drink.

One of my neighbors provides his fowls with no sort of protection in the way of a building, and so they roost in the low branches of a thicket near his house. Recently, during a severe storm, he found several crows roosting among the chickens. Upon being discovered, the crows flew off, cawing angrily over their disgust at being disturbed. Our crows are never shot or molested in any way, and have, therefore, become quite tame; but I never before heard of their entering into sleeping arrangements with barnyard fowls! But during such cold nights as we have had this winter—often from ten to twenty-nine degrees below zero—I do not wonder that birds flock together for mutual warmth "regardless of race, color or previous condition of servitude."—*Chas. Aldrich, Webster City, Iowa, Feb. 12, 1881.*

A Hawk New to the United States.—It affords me great pleasure to be able to announce, through your columns, the addition to the United States fauna, of a species of hawk hitherto not recorded from any point north of Mirador, Mexico, The question of what name the species should bear is one involving considerable investigation, pending which I will call it, provisionally, *Buteo fuliginosus* Sclater. It is a small species about the size of *B. pennsylvanicus*, but with longer wings and of a uniform black color, like *B. abbreviatus*. It has been considered by various ornithologists to be a darker or melanistic phase of *B. brachyurus*, but in this view I cannot concur, no specimens among the many I have examined, indicating that any light color phase exists; both young and old, though otherwise quite different, being uniform black below as well as above. While premising that this bird *may* be the *Buteo fuliginosus* of Sclater, it should be remarked that in "History of North American Birds" (Vol. III, p. 266), I referred to *B. swainsoni* on the presumption that it was probably based on a small example of the latter species in the dark phase of plumage; but I may have been wrong in this determination.

The specimen in question was shot at Oyster bay, Florida, Jan. 28, 1881, by W. S. Cransford, and was secured for the National Museum from W. H. Collins, of Detroit, Mich.—*Robert Ridgway in Forest and Stream.*

Curious instance in the Breeding Habits of the Blue-bird.—In April, 1879, while on a collecting tour near Prince Frederictown, Maryland, I found a nest of the blue-bird *(Sialia sialis)* in a hollow post. The eggs, five in number, were remarkably small, and in the body of the nest were three other specimens, abnormal in shape and very large. As this is the only instance of the kind I have ever heard of, it may not be amiss to record it. Either the original owners had been driven away by a new pair, who having rebuilt the nest, laid their own eggs; or the first three were deserted. The latter explanation is sustained by the small size of the five found in the upper part. Curiously enough both sets were perfectly fresh.—*A. M. Reynolds, Germantown, Pa.*

Zoological Notes.—The parasites of the white ant *(Termes flavipes)* have been described and illustrated in an elaborate way by Professor Leidy, in a memoir recently published in the Journal of the Academy of Natural Sciences of Philadelphia. They are profusely abundant in the intestine of the insect, and mostly consist of ciliated infusoria, which swarm in such myriads as to actually predominate over the real food in quantity. Besides a young nematoid worm and a gregarine, there are three or four infusoria, a vibrio, and a minute filamentous alga, which was previously known to inhabit the digestive canal of certain myriapods and a beetle *(Passalus cornutus)*.——In the thirteenth number of Vol. VIII of the Bulletin of the Museum of Comparative Zoology, Mr. Walter Faxon describes and figures certain deformities in the lobster, most of which appear to originate from injuries received after molting, before the new skin becomes hardened by the deposition of salts of lime. Mr. Faxon, after reviewing all the deformities which have been described among Arthropods, divides them into five categories: *(a)* of deficiency in nutrition, *(b)* of excess, *(c)* of transformation, *(d)* of arrested development, and *(e)* of hermaphroditism.——In an article on the mode of formation of the blastoderm in the Araneida, by A. Sabatier, translated in the *Annals and Magazine of Natural History* for March, it appears that the early development in the egg of the spider presents an intermediate type between eggs with general superficial segmentation of the Crustacea, such as Peneus, and the eggs with regular discoidal segmentation, such as those of certain fishes, that is to say, it has a blastulation intermediate between periblastulation and discoblastulation. It greatly approaches the eggs of Chelifer (Metschnikoff), Tetranychus (Claparède), and of insects (Bobretsky). Thus is plainly manifested from the outset the affinity of the Araneina with the groups of Arachnida and with the insects.——The Bezoar or guliga stones are concretions or calculi formed in the " stomach and intestines " of the red monkey, a species of Semnopithecus abundant in the interior districts of Borneo. Mr. A. H. Everett says (in the *Ann. and Mag. Nat. Hist.*, March) that "accounts vary very much among the natives as to the exact position in which the guligas are found, some saying they may occur in any part of the body, others that they occur only in the stomach and intestines, whilst I have heard others declare that they have taken them from the head and even the hand." (Everett does not state what would seem more probable, that they may be renal calculi.) The monkeys drink the water of certain springs, which must be saline mineral springs, or the creatures are cut off from the use of fresh water. Everett adds that " the widespread idea of the medicinal virtue of these concretions would lead us to suppose that there is some foundation for their reputation."——The *Cervus maral*, of Siberia, has recently been domesticated by Cossacks in the neighborhood of Kiakhta, in Western Siberia, where there are herds of seventy head. The horns of the wild deer, when filled with blood and not ossified, are much prized by the Chinese, who buy them at the Siberian border; but the horns of those which have been domesticated, lose a good many of their original qualities. ——In a recently-discovered stalactite cave at Kinchberg, near Kremsmünster (Austria), a jaw-bone of a man with well preserved teeth was found among numerous remains of *Ursus spelæus*.

ENTOMOLOGY.[1]

THE PERIODICAL CICADA, *alias*, " SEVENTEEN-YEAR LOCUST."—The present year will be marked by a quite extended appearance of this interesting insect, both a seventeen and a thirteen year brood simultaneously appearing. The readers of the NATURALIST are doubtless familiar with the habits and natural history of *Cicada septemdecim* Linn., and those of the thirteen-year race (*C. tredecim* Riley) which agree with it in every respect except in the time required for full development. We will, therefore, simply quote here, with brief comments, what was said in 1868, in the writer's First Report on the Insects of Missouri, regarding the two broods that

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

are to appear the present summer and that will be rendering the woods vocal with their rattling song, in the more southern parts

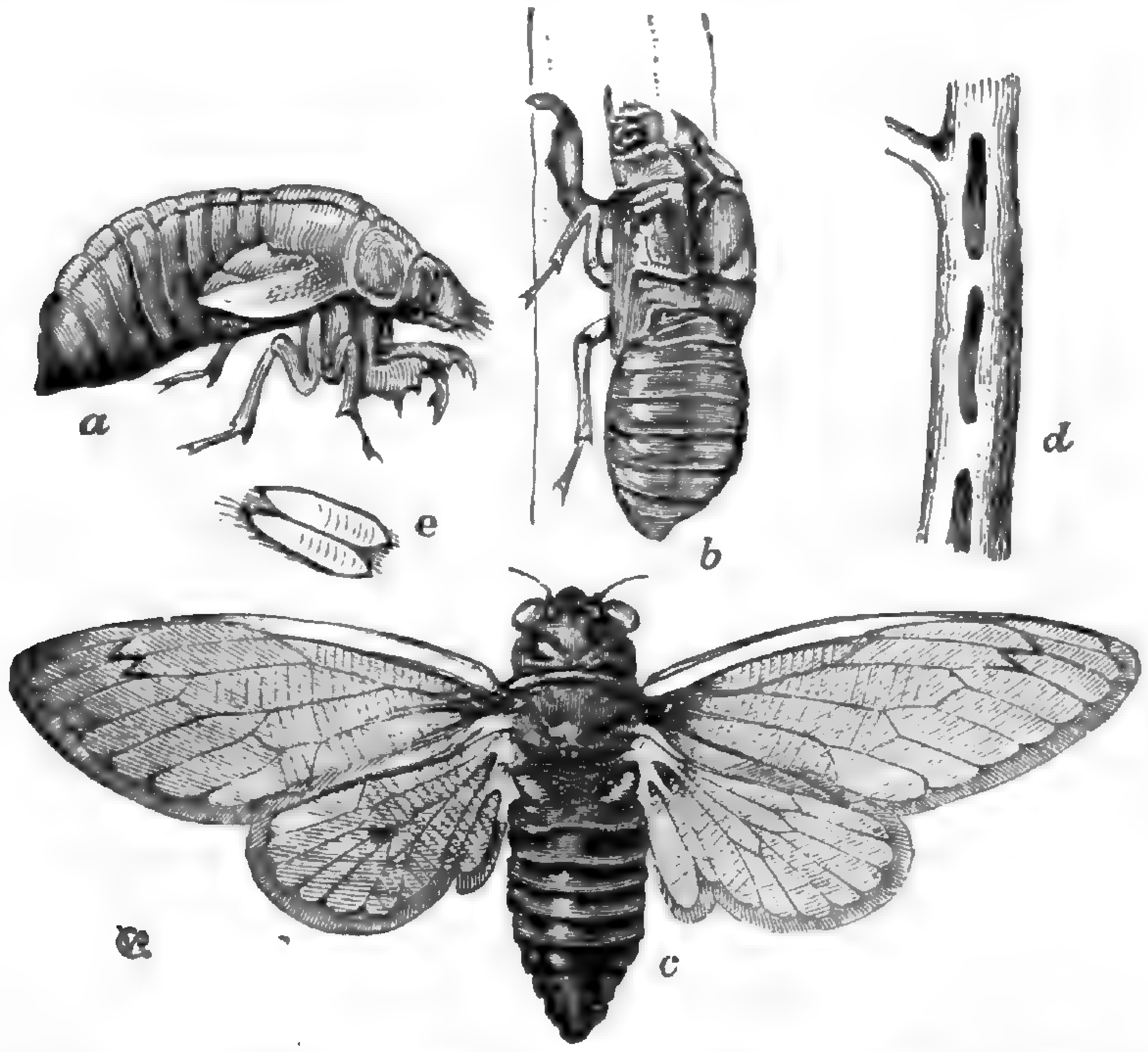

FIG. 1.—*Cicada septemdecim; a*, pupa; *b*, pupa shell; *c*, perfect insect ♂; *d*, twig with egg-punctures, nat. size; *e*, eggs, enlarged. (After Riley.)

of the country, by the time the present number of the NATURALIST is out.

BROOD XVII—*Septemdecim*—1864, 1881.

In 1881, and at intervals of seventeen years thereafter, they will, in all probability, appear in Marquette and Green Lake counties, in Wisconsin, and may also appear in the western part of North Carolina, and about Wheeling, Virginia; in Northeast Ohio, and a few in Lancaster county, Pa., and Westchester county, New York.

There is abundant evidence that they appeared in the counties named in Wisconsin in 1864, and fair evidence that they appeared that year in Summit county, Northeast Ohio, while straggling specimens were found in the same year, by Mr. S. S. Rathvon, in Lancaster county, Pa., and by Mr. James Angus, in Westchester county, N. Y. Dr. Fitch also records their appearance in 1847, or seventeen years previously, in the western part of North Carolina, and Dr. Smith, in Wheeling, Virginia, in 1830, '47. and '64. The distance between the localities given is very great, and it is doubtful whether all these records belong to one and the same brood.

BROOD XVIII—*Tredecim*—1868, 1881.

In the year 1881, and at intervals of thirteen years thereafter, they will, in all probability, appear in Southern Illinois, throughout Missouri, with the exception of the north-western corner, in Louisiana, Arkansas, Indian Territory, Kentucky, Tennessee, Mississippi, Alabama, Georgia and North and South Carolinas.

Though, as already stated, I published the first account ever given of the existence of a thirteen-year brood, yet, besides the others mentioned in this chronology, this particular brood has been traced since, as having occurred in the years 1816, '29, '42, '55, and '68; and Mr. L. W. Lyon, at the July (1868) meeting of the Alton (Ills.) Horticultural Society, even mentioned its appearance in 1803.

In Missouri it occurs more or less throughout the whole State with the exception of the north-west corner that is bounded on the east by Grand river, and on the south by the Missouri river.[1] The south-east part of the State, where Dr. Smith has re-

[1] As Mr. Wm. Raucher, of Oregon, Holt county, saw a few individuals in the north-east part of Buchanan county in 1855, it may occur in small numbers in districts even north of the Missouri river.

corded it since 1829, is most thickly occupied. I enumerate those counties in which there is undoubted evidence of their appearance during the present year (1868), viz: Audrain, Bollinger, Benton, Clarke, Chariton, Callaway, Cooper, Cole, Franklin, Gasconade, Iron, Jefferson, Knox, Lewis, Marion, Macon, Morgan, Moniteau, Pike, Phelps, Pulaski, Polk, Pettis, Schuyler, St. Charles, St. Louis, St. Francois, St. Clair, Warren and Washington.

It not improbably overlaps some of the territory occupied by the *septemdecim* Brood XIV [a brood which appeared last in 1879], but I do not think it extends into Kansas.

In Illinois it occurs more or less throughout the whole southern half of the State, but more especially occupies the counties from the south part of Adams county along the Mississippi to the Ohio, up the Ohio and Wabash rivers to Edgar county, and then across the center of the State, leaving some of the central counties in South Illinois unoccupied. To be more explicit, I enumerate all the counties in which it undoubtedly occurred during the present year (1868): Adams (south part, back of Quincy), Bond, Clinton (north-west corner, adjacent to Madison), Champaign, Coles, Crawford, Cumberland, Clay, Clark, Edwards, Edgar[1] (especially in the eastern part), Franklin, Gallatin, Hardin, Hamilton, Johnson, Jasper, Jersey, Jefferson, Lawrence, McLean (east end), Macon, Madison, Marion, Massac, Monroe, Pike, Perry, Piatt, Pope, Richland, Randolph, Sangamon, Saline, St. Clair, Union (north east corner), Washington, Wayne, Wabash, Williamson and White. There were none the present year, either at Decatur, in Macon county, or at Pana in Christian county; nor were there any at Bloomington or Normal, in McLean; nor in Dewitt county, which lies south of McLean; nor in Spring Creek, Iroquois county, which is north-east of Champaign.

In Kentucky, according to Dr. Smith, it occurred in the north-west corner of the State, about Paducah and adjacent counties south, in 1829, '42 and '55, and it occurred there in 1868.

In Arkansas, it occupied all the northern counties in 1842, '55 and '68.

In Alabama, it occupied Russell and adjacent counties on the east side of Black Warrior river, in 1842, '55 and '68.

In Tennessee, it occupied Davidson, Montgomery, Bedford, Williamson, Rutherford and adjacent counties, in 1842, '55 and '68.

In North Carolina, it appeared in Mecklenburg county, in 1829, '42, '55 and '68.

In South Carolina, the Chester district and all the adjoining country to the Georgia line, west, and to the North Carolina line, north, was occupied with it in 1816, '29, '42, '55 and '68.

In Georgia, it has occurred in Cherokee county since the year 1816.

In Louisiana, it appeared in Morehouse, Caddo, Clairborne, Washington and adjacent parishes, in 1855 and '68.

It also doubtless occurs in Mississippi and Indian Territory, though I am unable to specify any localities.

The last simultaneous appearance of these two broods was in 1860, and their appearance the present year will doubtless enable us to perfect our knowledge of the geographical range of either. Already we have received undoubted indications of their early ascension, as the pupæ have been reported either near or upon the surface of the ground in several of the localities indicated.

It will be observed that the thirteen-year brood (XVIII), is by far the most extended, and that it occurs very generally throughout the Southern States, both east and west of the Mississippi. We have gathered together since the last appearance of this brood in 1868, various facts which extend its range in Georgia and Tennessee, and which show that it also occurs in restricted parts of Indiana.

We shall be very glad to receive detailed information of the

[1] Edgar county also has the *septemdecim* Brood III.

exact limits of either of these two broods, or indeed any record of the appearance of the insects the present year, and these records will be all the more valuable if the years of earlier appearances in the same localities can also be furnished. Information on these points should be sent to the editor of this department.

A NEW SPECIES OF OAK COCCID MISTAKEN FOR A GALL.—An esteemed correspondent from Ohio (Dr. Jno. A. Warder) sends us what he supposed to be some kind of gall which he found at Iron mountain, Mo., on the twigs of *Quercus palustris.* They are pretty large, globular or almost globular, objects fastened to the twigs either singly or in clusters, as we are accustomed to see certain Cynipid galls. Their shining, yellowish surface is handsomely variegated with light-brown patches and with undulating or interrupted black lines. These objects have frequently been mistaken for galls, even by entomologists, but they are in reality the female scales of a Coccid, and are often infested by a Lepidopterous inquiline, *Euclemensia bassettella* (Clem.).

The particular species sent by our correspondent is tolerably common in the South and West on the twigs of different species of the black oak group. It is undescribed, and may be characterized as follows:

Kermes galliformis n. sp. Mature ♀ scale, average length 5 mm. Subspherical, usually somewhat broader than long, and often with a broad shallow constriction medio-dorsally. Attached by a broad, dark-brown cut or excavation, which is covered by a beak anteriorly and notched anally, the brown color extending to a point above the notch. Polished and smooth. Ground color pale yellowish, appearing under lens minutely and evenly speckled with brown; more or less suffused or mottled with gray or brown, the constriction, when present, generally dark. A series of about seven irregular rows of black punctations running across the scale, often connected by an irregular black line, and this again relieved by white or pale yellow. The three uppermost rows most distinct and constant.

The species is quite variable, the general shape and the form of cut point of attachment varying according to the position on a twig or as individuals are crowded; while the general color varies according as one color or the other predominates. Specimens which we have from New Mexico are uniformly without the constriction and with a pale-gray rather than a pale-yellow ground color. Prof. Comstock, Entomologist of the Department of Agriculture, is at work on this family of insects, and will, we hope, soon give us the natural history of many of the interesting forms, of the development of which nothing has so far been recorded.—*C. V. Riley.*

THE "WATER-WEEVIL" OF THE RICE PLANT.—In the February number we called attention to two of the worst insect enemies of the rice plant, first, the "grub," which injures the plant when the water is withdrawn from the soil, and which is the larva of *Chalepus trachyperus* Burm.; second, the "maggot," which has not yet been identified in the imago state, and which we suggested might possibly be the larva of *Spalacopsis suffusa* Newm. We have recently received the following interesting communication from Mr. John Screven, of Savannah, Ga., the specimens accompanying it being *Lissorhoptrus simplex* Say—a tolerably common species throughout the eastern part of the country, and found on various other water plants, so that it is probably not confined to rice as food. We have little doubt but that Mr. Screven is correct in his deduction that this snout-beetle is the parent of the "maggot," in which event the larva differs from the more typical larvæ of the Curculionids, in being quite elongate and not arched. Mr. S. writes as follows:

I send you by express a number of "water-weevils" preserved in alcohol, together with some specimens of the young rice leaves on which they were found feeding. You will observe on the latter the method of the insect in feeding, and will find no difficulty in concluding that when in sufficient numbers, as is sometimes the fact, they may do much damage in the rice fields.

I have observed with great interest and attention your allusion to this insect in the general notes from the AMERICAN NATURALIST, Feb., 1881. But it has suddenly occurred to me as possible that these "water-weevils" are the perfect insect of the "maggot" larva which I sent to you last summer. Allow me to suggest some reasons for this opinion.

1. Both the weevil and the maggot are water insects; both seek the same food, namely, the rice plant, differing however in this, that the one feeds on the leaf and the other on the root of the plant.

2. They differ in their periods of existence, the weevil appearing in April and May, the maggot in the summer months; but this may account merely for the time and circumstances necessary to incubation. Among the specimens sent you, I found several pairs in what appeared to be the act of copulation. These specimens were taken yesterday, April 29th, many of them *in the very spot where were found the maggots which I sent you last summer.* My first note of the latter was July 13th, and allowing one week for the appearance of the weevil after the fields are inundated for the stretch flow, the latter would be found, say, April 17th, making an interval of say ninety days between weevil and maggot, or between the beetle and the larva. This may appear an over-long period, but I assume that water is necessary to the generation and existence of this insect. Now, the "stretch water" does not last more than thirty days. At the expiration of this time the fields are drained and kept dry for at least thirty, very often forty days, and I presume that this fact, forbidding incubating during this period, it would not commence until the harvest flow is put on the fields. In 1880 this flow was applied say June 18th. The maggot was found July 13th, say thirty days after. I am quite ignorant of the periods of insect incubation, but it appears that if water is necessary to the generation and existence of this insect, the "maggot" larva, if from the water weevil, will hatch within thirty days after the harvest water is applied to the fields.

3. The water weevil and the maggot are found in the same habitat, and both disappear on the removal of the water in which they live. I may note here that the weevil is sluggish in its habits, is easily caught, and never "plays possum." It is seen in the greatest numbers in the early morning, feeding on the delicate leaves of the plant, and seeks, crawling down the stem, the cooler recesses under water as the sun grows warmer. Many, however, feed all day.

THE IMPREGNATED EGG OF PHYLLOXERA VASTATRIX.—It is interesting to note how, one by one, all the conclusions we have in former years arrived at, are verified and their accuracy established by European observers having, presumably, no knowledge of what we have recorded. In 1875 (see Transactions St. Louis Academy of Science, Nov. 5, 1875, p. 286) we remarked: "Having already had the young from the impregnated egg of *rileyi* hatch in about a fortnight after it was laid; having shown in previous writings that this species winters in the larva state, and not in the impregnated egg as does the European *quercus;* and remembering further, that *vastatrix* resembles *rileyi* in wintering as larva, it is safe to conclude that the impregnated egg of *vastatrix* will also hatch the same season that it is laid, and that we cannot apply to it the term 'winter egg,' which Balbiani applies to the impregnated egg of *quercus.* It is not unlikely that since a few of the winged females issue as late even as the latter part of October, some few also of the later produced impregnated eggs may pass the winter unhatched; if so, they may be considered exceptions to the rule. In the same way, a few of the more common eggs from the agamous ♀ may be exceptionally found on the roots in winter, though as a rule only the hibernal larva is found." In the April number of *La Vigne Americaine,* M. P. Graells records some interesting experiments in Spain which establish the fact beyond all peradventure that this impregnated egg is produced there from the months of June to November inclusive, and that the earlier laid eggs hatch and produce the stem-mother a few days after thay are laid. In this we have the true explanation of the larval hibernation of *Phylloxera vastatrix,* corresponding, in fact, with that of *P. rileyi.*

Works on North American Micro-Lepidoptera. — Lord Walsingham's "North American Tortricidæ,"[1] which lays the foundation for a study of the Tortricids of the Pacific coast, and gives a scientific value to Walker's North American species, has already been reviewed by Professor Fernald in *The Entomologist's Monthly Magazine* for September, 1880 (the notice repeated in *Psyche* for October), and by Mr. Grote in *Papilio* for January, 1881. It will be unnecessary to repeat their comments, but as the book is indispensable to any one engaged in studying the parents of our "leaf-rollers," we take pleasure in calling further attention to it. The number of new species collected by Lord Walsingham in California and Oregon, is very large, and there are, besides, several new species described from Texas and a few from other parts of the country.

The illustration and description of Walker's species has been most ably and generously performed. That the coloring of some of the figures is faulty, or not in exact agreement with the descriptions in the text, is doubtless due to the poor condition of the specimens from which Walker described many of his species. It has been suggested that in cases where more than one species has been described by Walker under the same name, the last word has not been said; but it is evident to us that if either of these species had been previously named and described, Walker's name

[1] *Illustration of Typical Specimens of Lepidoptera Heterocera in the collection of the British Museum.* Part IV.—North American Tortricidæ. By Lord Walsingham. London, printed by order of the Trustees. 1879. 4to, pp. 84, with 17 colored lithographic plates.

must sink as a synonym of that earlier name and should not be used for any other species. The application of this principle will doubtless serve to settle the synonymy of his "*Grapholitha discoferana*," among others.

The new genera are *Hendecastema* (which Professor Fernald has, in his review, shown to be synonymous with Clemens's prior genus *Amorbia*), peculiar for the pectinate antennæ of the male, and for vein seven of the primaries being forked in the female but not in the male; *Synnoma*, also with pectinate male antennæ, remarkable for the great size of the abdomen of the female; *Hystrichophora*, differing from Phoxopteris in the longer palpi; and *Proteopteryx*, allied to Grapholitha but peculiar for an abrupt indentation of the posterior margin of the primaries upon vein five, and for the curving of veins three and four towards it. We may add in regard to *Proteopteryx* that *Hedya spoliana* Clem., and *Hedya cressoniana* Clem., have identically the same structure, and will doubtless take their place in that genus; but that this character is not confined to a single genus is evident from its occurrence in a new genus which we have, in a paper just published,[1] named *Proteoteras*, and which differs from *Proteopteryx* in the rough scaling of the primaries and the presence of a peculiar costal tuft on the male secondaries.

One of the more remarkable species described, *Carpocapsa latiferreana*, we have found, by breeding the male, to present characters for a distinct genus, allied to Zeller's Ecdytolopha, which we have named *Melissopus* (*l. c.* p. 322), the origin of vein two of secondaries being nearer the base of the wing than in Carpocapsa, and the male having a very deep pocket behind this vein and having the posterior tibiæ and tarsi greatly dilated.

A list of forty-eight species of Tortricids common to Europe and North America is given. This is a valuable contribution to the subject of the geographical distribution of the Lepidoptera, the strongest relationship being traced between Europe and the Pacific coast of North America. As Lord Walsingham deals more particularly with these western species, it may be that a similar treatment of our eastern Tortricid fauna will produce nearly corresponding results, although here the introduced species may play an important part. The species in this list which are of interest to the economic entomologist, are, *Retinia duplana* Hüb., *Retinia sylvestrana* Curt., and *Retinia pinivorana* Zell., all from Oregon; *Eudemis botrana* Schiff., which has been known in America as *Penthina vitivorana* Pack., *Phoxopteris comptana* Fröl., supposed to be the same as *Anchylopera fragariæ* W. and R., though Prof. Fernald finds that we have the European *comptana* here and believes that *fragariæ* is a good species; *Tmetocera ocellana* (Fabr.), and the well-known *Carpocapsa pomonella* (Linn.). As introduced species there should be added to the list *Dapsilia rutilana* Hübn.,

[1] Descriptions of some new Tortricidæ, Trans. Ac. Sc. St. Louis, IV, p. 321.

treated of in our Report to the Department of Agriculture for 1878, and probably *Eulia ministrana* which we have received from the late Dr. LeBaron of Illinois, and also *Spilonota roborana* Schiff. (*cydnosana* Fabr.) which we have reason to believe is the same as *Hedya Scudderiana* Clem. = *Euryptichia saligneana* Clem. = *Pædisca affusana* Zell.

In regard to the conventional specific ending to the names of Tortricids, we notice that Lord Walsingham follows Zeller in making it conform to the gender of the generic name; thus we have *Lophoderus gloveranus* and *Exartema sericoranum*.

Lord Walsingham's paper on Tineidæ[1] and his "Pterophoridæ of California and Oregon,"[2] have been reviewed by Mr. V. T. Chambers and Mr. Charles Fish in the November number of our contemporary, the *Canadian Entomologist.* In the latter monograph appears the first general treatment of any portion of the North American species and the success of Lord Walsingham's collecting in California and Oregon is shown in the discovery of twenty-seven new species of this restricted group of moths, making the whole number known from Northwest America, thirty-eight. Some interesting introductory remarks are given in regard to the geographical distribution and variation of the species; and a new genus, *Trichoptilus*, is proposed for "probably the smallest known species of Pterophoridæ," differing from all other genera in the front wings being cleft to the middle and in the tuft of scales on the third lobe of the hind wings being situated only just beyond the middle.—*C. V. R.*

Moths Mistaken for Aletia.—Mr. F. A. Walthall, of Newburn, Ala., sends us a number of moths, which he captured during the latter half of February flying in immense numbers at evening time around buildings, and which he supposes to be the cotton-moth. They are, however, all *Platyhypena scabra* (Fabr.), which has been so often recorded by us as being mistaken for Aletia. This Platyhypena is by far the most common winter moth in the South, and while it is a difficult task to find during the cold spells of a southern winter any other Noctuids which we know to hibernate as imago and which are seen flying about on warm evenings, this species can always be found, even during the coldest spell. A very slight shelter, such as the loose bark of dead trees, fence posts, etc., is sufficient to protect it from the cold, and it has been found alive in such places where other hibernating insects, *e.g.*, Carabidæ and Heteroptera were frozen stiff and dead.

Several other correspondents have lately sent moths from the South under the supposition that they were Aletia. Those from Mr. J. W. Burch, of Fayette, Miss., and from Mr. H. Hawkins, of

[1] *On some new and little known species of Tineidæ.* By Thomas, Lord Walsingham. 8vo, pp. 17, 2 plates. From Proc. Zoöl. Soc., London, 1880.

[2] *Pterophoridæ of California and Oregon.* By Thomas, Lord Walsingham. 8vo, pp. 66, 3 plates. London, John Van Voorst, 1880.

Hawkinsville, Ala., are *Phoberia atomaris*, while those from Mr. J. S. Newman, Atlanta, Ala., are the Platyhypena above-mentioned.

Scale Insect on Raspberry.—Mr. R. B. Fulton, of Oxford, Miss., sends us a raspberry cane covered with a scale insect, with the following remarks: "The insect has been ruinous to the black-cap raspberry in this vicinity for the last three or four years. Old raspberry plants have been dug up and thrown away to get rid of the pest. It first appeared (or was noticed) in one garden, and has spread to all in this vicinity. If it is a bark-louse, and if, as is stated by Harris, the female has no wings, how could the insect have spread so rapidly to six or eight gardens? I have not noticed it on the red or yellow raspberry. It multiplies so fast that it seems useless to try to kill it by any applications to the plant."

The whitish, flat, either broady-oval or round scales on the cane are, judging from the scales and eggs, those of the wide-spread Harris's bark-louse (*Diaspis harrisii* Walsh), which is known to infest various trees and shrubs. The mode of spreading of this and other scale insects, the females of which never acquire wings, is more rapid than is generally supposed. The young lice which hatch in the spring are very active during a few days, and can overrun a large garden in a very short time. They may easily be carried from one garden to another by the wind or by the aid of birds or flying insects. In most cases, however, the female scales are transported from one place to another on cuttings and nursery stock. The best way to counteract the ravages of this insect is to dig up and burn, in winter-time, *all* infested plants. New plants should always be carefully examined and thoroughly cleansed before planting.

Specific Value of Apatura alicia Edw.—Mr. W. H. Edwards gives, in the October number of *Psyche*, recently issued, a full account of the adolescent stages of this species and concludes that its specific value is confirmed thereby. Bearing in mind the variation which we know to occur in the larva of *Apatura celtis*, we are constrained to attach less importance to the slight differences which Mr. Edwards points out between it and the larva of *alicia* than he himself gives to them. The facts brought out, however, strengthen the claim of *alicia* to stand as a name characterizing a special form. Whether it be considered a good species or not is hardly worth discussing on account of the great latitude of opinion as to what constitutes a species.

ANTHROPOLOGY.[1]

Anthropology in Germany.—Just as the Journal of the Anthropological Institute represents our science in England, and the Bulletins, Revue and Materiaux, exhibit the labors of anthropologists in France, so in Germany the cream of all contributions

[1] Edited by Prof. Otis T. Mason, Columbian College, Washington, D. C.

finds its way into the Archiv für Anthropologie. The first and second quarterly parts of the thirteenth volume close the year 1880. The volume consists of original papers, shorter communications, reviews, and reports of meetings.

The original contributions are as follows:

1. The occurrence of a tail on human beings, pp. 42, 1 table, by Dr. Max Bartels, of Berlin.
2. Monuments and localities with which the myth of Nerthus is associated. A communication to the Anthropological Society of Kiel, March 16, 1880. [This paper is founded upon a passage in the Germania of Tacitus, chapter 40.] pp. 10, by Heinrich Handelmann.
3. Circumcision, by Richard Andree.
4. Contribution to a Craniology of the European races. 1. With a table of curves, by Professor J. Kollman.

Quite extended reviews appear of Mook's "Prehistoric Egypt," Hart's "Stone implements in the Museum of Rio Janeiro," Molon's "Ligurians," Habel's "Sculptures of Santa Lucia," Rau's "Palenque Tablet," and "Archæological collections in the National Museum," Bell's "Jungle Life," Marty's "Color Sense," Emmert's "Eye and Skull," and Valentini's "Calendar Stone."

A supplement of 160 pages contains a stenographic report of the eleventh general meeting of the German Society of Anthropology, Ethnology and Prehistory in Berlin, August, 1880. Nos. 9, 10 and 11 of *Correspondenz-Blatt* give an account of the organization, a list of the members, a résumé of the proceedings, and a catalogue of works presented at the meeting.

ANTHROPOLOGY IN FRANCE.—The *Revue d'Anthropologie* for January of the current year, furnishes the following contributions to our knowledge:

Quelques subdivisions des groupes basés sur l'indice cephaliques, by Paul Broca.

De l'embryogenie dans ses rapports avec l'anthropologie (Leçon d'ouverture a l'Ecole d'Anthropologie), by Mathias Duval.

Classification et chronologie des haches en Bronze, by M. Gabriel de Mortillet.

Les Negres chez eux (Part 2), by M. Mondiere.

Sur quelques crânes de criminels et de suicides, by MM. Ten Kate and Pavlovsky.

Revue Critique—"Les Samoyedes," of Zograf and Bogdanof.

Rev. Préhistoriques—Soc. d'Anthrop. de Paris; The antiquity of Man in Dauphiny, etc.; Anthropological Society of Berlin, and Congress of Prehistoric Archæology at Lisbon.

Revue des Livres—Crania ethnica; and Discovery of America by the Normans in the 10th century.

Revue des Journaux—French, Italian, American, English, German.

Miscellanea—Société d'Anthropologie; Laboratory of Anthropology of the School of Higher Studies; Conferences on Anthropology by the Faculty of Sciences at Lyons; On anthropological instruction in Italy; Congress in Algiers in April, 1881.

Bibliography—Six closely printed pages are devoted to bibliography.

THE EGYPTIAN STONE AGE.—The New York *Nation* for January 13, alludes to the researches of Dr. Mook as finally setting at rest the greatly disputed question as to the existence of a Prehamitic population in the valley of the Nile. In the number for

January 27, Mr. Henry W. Haynes, of Boston, calls the attention of the editor to the fact that as early as 1868 he himself had discovered palæolithic axes of the St. Acheul type, together with a most extensive series of all the usual implements that are found in other countries in which the existence of the "stone age" is regarded as established. Mr. Haynes also states that it was he who first directed Dr. Mook's attention to the palæolithic implements, and complains that Dr. Mook has almost totally ignored him in his work. The death of Dr. Mook, recently announced, will deprive our countryman of the explanation which is justly his due.

Prehistoric Illinois.—At the second annual meeting of the State Natural History Society of Illinois, held in the State House at Springfield, Feb. 8--10, the following papers were read: "The ancient agricultural implements of stone found in the Illinois river bottoms and in the mounds in the Mississippi valley," by the Hon. Wm. Mc. Adams, of Otterville; "The Palenque Tablet," by Professor Cyrus Thomas; and "The Ancient Illinois," by the Hon. J. G. Henderson, of Winchester. Only the most meager report of these interesting papers has reached us, hence the brevity of this notice.

Ancient Works in New York.—There are within ten miles of Watertown, N. Y., many ancient fortified village sites, not to speak of those obliterated by the plow. We cannot use the term mound, as applicable to this locality, for there are no artificially constructed mounds found here. One of the most marked features is, that all these sites were fortified, or defended with ditches. They are nearly all located upon the sandy moraines of extinct Adirondac glaciers, or sand strewn hills. A few fishing stations along the shores of Lake Ontario and Black River bay are the exceptions, and even these are upon sandy slopes. There seems to be no uniformity in the shape or construction of the lines of defence; one at Black River bay had the ditches in the form of circles, one within the other, and a lunette towards the water, with a protected roadway to the shore. One in Rutland, on the farm of Mr. Gragg, has the trench cut across the base of a peninsula, between two forks of Sandy creek, a steep hill serving as embankment for the rest of the enclosure, and usually the lines run along the edges of an escarpment. I am informed by several of our elderly inhabitants, that these lines of entrenchments near our cemetery, were a mile and a half long, and some of the trenches five feet deep. Pottery of the usual forms, and nearly always broken into small pieces, is a constant accompaniment of these fortified sites, and it is generally blackened on the inside with charred food, showing that the owners cooked with heated stones thrown into the vessels. The jar or pot, the most perfect specimens I have met with, was dug up in the town of Rutland many years since, and is owned by Mr. J. A. Lawyer of this city. Arrow-heads, stone-axes, scrapers, knives, bone awls, charred corn, etc., found west and south, are dug up from the graves of these people, or strew the sites of their homes.—*David S. Marvin.*

The American Antiquarian.—The number for January of this useful Journal makes the following contributions to anthropology:—The military architecture of the emblematic Mound-builders, by the Rev. S. D. Peet; Oregon and her Prehistoric relics; Lookout mounds in Ohio; Earthworks on the Missouri river; The ancient pottery makers; Wisconsin copper finds and lake dwellings; The rapid formation of rock strata in Oregon; Wild rice; Nest of flint relics; The Mound-builders in Minnesota; Indian relics in a mound; Ancient man in Missouri; Relics of the Mound-builders near Joliet Ill.; Gold ornaments in Tehuantepec; Aleutian mummies.

German Anthropology.—Our readers will remember that there was an exhibition of the prehistoric and anthropological collections of Germany in Berlin, from 5–21 August, 1880, under the protection of the Crown Prince, and in connection with the eleventh annual meeting of the German Anthropological Society. Under the direction of Dr. A. Voss, of Berlin, an illustrated catalogue and supplement have been published, 619 and 48 pages. In these volumes are brought together not only descriptions of the objects exhibited but catalogues of books and lists of localities which makes them really a complete hand-book of German anthropology.

Anthropology in Great Britain.—The Journal of the Anthropological Institute is coming more and more to reflect the labors of British anthropologists. In the number for November, 1880, No. II, Vol. X, the original matter is supplemented by ten pages of miscellanea. The original papers are as follows:

Notes on Fijian Burial Customs. By the Rev. Lorimer Fison.

Flint Implements from the Valley of the Bann. By W. J. Knowles, Esq.

On the cranial characters of the natives of the Fiji islands. By W. H. Flower, LL.D., F.R.S.

The Ethnology of Germany. Part V. The Jutes and Fomorians. By H. H. Howorth.

Observations upon the methods and processes of Anthropometry. By Dr. Paul Topinard.

The Japanese People: their origin and the race as it now exists. By C. Pfoundes.

The paper of greatest value to the readers of the Naturalist is that of Dr. Topinard. Anthropometry is the measurement of the entire human body, to determine its proportions: 1, at different ages, to learn the law of the relative growth of parts; 2, in races, so as to distinguish them; 3, in all environments, in order to ascertain their influence on variation. As the few skeletons in our museums are insufficient to obtain a just average, all our efforts should tend to perfect the methods of operating on the living, and to simplify them so as to render them available by travelers, officers of the army and navy, recruiting agents, teachers, etc. To obtain good measures one should demand only a few, such as height, breadths, some circumferences, and perhaps the facial angle.

The center of the patella, adopted in the statistics of the Civil war is preferred upon the living to all others, as one datum point. From the summit of the olecranon to the upper border of the head of the radius is another. And, indeed, Dr. Topinard boldly affirms that when it is impossible to reconcile anatomical exactness with external configuration, the former must give way. Those engaged in anthropometric investigations cannot afford to omit reading this paper.

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GEOLOGY AND PALÆONTOLOGY.

THE TACONIC SYSTEM IN GEOLOGY.[1]—The existence of a series of stratified rocks in the Appalachian valley, intermediate in age between the older crystalline or primitive schists and the Palæozoic rocks of the New York system, was taught by Eaton and main-

[1] Abstract of a paper read before the National Academy of Sciences at Washington, April 18, 1880.

tained by Emmons, whose Taconic system, as first proposed, was later declared by him to consist of an upper division, which he referred to the horizon of the calciferous sandrock of the New York system, and a lower division, the proper Taconic. In this latter was included a great group of quartzites, limestones, and soft crystalline schists, which have since, by different geologists, been assigned to not less than three distinct horizons in the New York system. The grounds of those contradictory opinions have been supposed stratigraphical relations, and also the apparent association with the Taconic limestones of organic remains belonging to these various horizons.

In localities away from the disturbed regions of the Appalachian valley there exists a series of rocks occupying the position assigned by Emmons to his Lower Taconic, and agreeing with this in its essential characters. Such a series is found north-west of the Appalachian region, a little to the north of Lake Ontario, where it rests upon schists like those of the Green mountains, and is unconformably overlaid by the Trenton limestone, and totally distinct from the lower members of the New York system in the adjoining region. Another locality is to the south-east of the Atlantic belt, in southern New Brunswick, where a similar series of several thousand feet of limestones, quartzites and schists occupies a position inferior to the fossiliferous Cambrian (Menevian). In both of these localities the rocks in question correspond closely in volume and in mineralogical characters to the Lower Taconic rocks of the Appalachian valley, with which the speaker believed them to be identical.

Again, Mr. W. O. Crosby has lately described a similar series in the Island of Trinidad, resting on the ancient crystalline rocks and overlaid unconformably by limestones of Trenton age.

We have thus abundant evidence of a great and wide-spread series of rocks, pre-Cambrian in age, and occupying the position assigned by Emmons to the Lower Taconic or Taconian system —which, according to him, extends continously along the Appalachian valley from Vermont to Alabama, and moreover occupies large areas to the south-east of the Blue Ridge, from Virginia to Georgia, constituting, in South Carolina, the Itacolumite series of Lieber.

Within the vast region occupied by these rocks in the great valley, have been found a few small areas of fossiliferous strata, belonging chiefly to the Ordovian (Siluro-Cambrian) or to the Cambrian series; but the characters of the great mass of these rocks are such as to lead to the conclusion that they constitute, as maintained by Emmons, a more ancient series.

To the Taconian rocks belong the peculiar magnetic iron-ores found at Reading, Cornwall, and Dillsburg, Penn., which have been by some geologists regarded as Mesozoic, but were by Rogers assigned to the base of the Palæozoic. To this same series belong the limonites of the great valley, which occur in clays derived from the sub-aërial decay of the rocks. These rocks, in their unchanged condition, contain beds and masses of siderite and pyrites, the alteration of which *in situ* has given rise to the limonites. In the formation of this from siderite or iron-carbonate, it was pointed out by the speaker that there is a contraction of volume equal to about 20 per cent; to which is due the cellular character of the limonites and their frequent occurrence in the form of geodes.

These older rocks are not without traces of organic life, having yielded in the Appalachian valley the original *Scolithus*, and related markings, besides obscure *Brachiopods*; and in Ontario, besides similar Scolithus like-markings, a form apparently identical with the *Eozoön* of the more ancient gneisses. We may hope to find in the Taconian series a fauna which shall help to fill the wide interval that now divides that of the Eozoic rocks from the Cambrian. We should seek in the study of stratigraphical geology not the breaks dividing groups from each other, so much as the beds of passage which serve to unite all these groups in one great system, remembering that there is no local hiatus which is not somewhere filled up by the continuous process of nature.—*T. Sterry Hunt.*

A FOSSIL PHYLLOPOD CRUSTACEAN FROM THE QUATERNARY CLAYS OF CANADA.—We have received through the kindness of Principal J. W. Dawson, LL.D., of Montreal, a valve in partial preservation, of an Estheria quite unlike any existing American form. The following account of its discovery is from Principal Dawson:

"It was found at Green's creek on the Ottawa river, in nodules in the Post-pliocene clay, holding skeletons of *Mallotus villosus* and other northern fishes, and shells of *Leda (Portlandia) arctica*, *Saxicava rugosa*, &c.; also leaves of Populus, Potamogeton, &c. The deposit is of the age of the Leda clay of the St. Lawrence (middle glacial) and belongs to a period of submergence where in the bay or estuary then representing the Ottawa river, northern marine animals were imbedded in deposits into which was also washed the débris of neighboring land, and of fresh water streams. The climate at the time was colder than at present, and the area of land less, so that if this Estheria still lives, it is most likely to be found in the vicinity of the Arctic coast."

This Estheria is entirely unlike any northern American or European species, differing decidedly from *Estheria morsei* or *E. caldwelli* and *E. clarkii*. It rather approaches *E. jonesii* from Cuba in the form of the shell and style of marking of the valves. It does not resemble closely any of the fossil forms figured in Jones' Monograph of fossil Estheriæ. The markings, however, present some resemblances to *E. middendorfii* Jones, but differs in the want of anastomosing cross wrinkles between the ridges.

One valve and portions of others were preserved; but none of them show the beaks (umbones), though the form of the remainder of the shell indicates that they were situated nearer the middle of the valve than usual, *i e.*, between the middle and the anterior third of the shell. The shell is deep, probably more so than in *E. jonesii*, though the valves have evidently been flattened and somewhat distorted by pressure, but apparently the head-end was more truncated than in *E. jonesii*, as the edge of the shell and the parallel lines (or ridges) of growth along the head-end are below bent at right angles to the lower edge of the shell. The raised lines of growth are very numerous and near together; they are of nearly the same distance apart above near the beaks as on the lower edge. The very numerous lines of growth are thrown up into high sharp ridges, the edges of which are often rough, finely granulated, and often the valleys between are rugose on the surface. In one or two places a row of papillæ for the insertion of spinules may be seen where the shell has been well preserved, and between many of the lines of growth there are irregular superficial ridges. Length 10 mm.; depth 7.5 mm.

The valve is evidently that of an Estheria, much truncated anteriorly, and with the lines of growth much thicker, higher and closer together than in any North American species known to us, and may prove when better specimens are found, to be allied to the tertiary Siberian *E. middendorfii.*

The species is named in honor of the discoverer, J. W. Dawson, LL.D., who has so persistently and ably investigated the Leda clays of Canada.—*A. S. Packard, Jr.*

Miocene Dogs.—In the Bulletin of the Hayden Survey, Vol. VI, p. 177 (Feb., 1881), I gave a synopsis of the genera and species of this family found in the Lower Miocene formation of the Western Territories. These numbered seven and nineteen respectively. The recovery and discovery of some material since that date, enables me to make the following corrections and additions: (1) The proper dental formula of *Hyænocyon* is I. $\frac{?}{3}$; C. $\frac{1}{1}$; Pm. $\frac{3}{3}$; M. $\frac{1}{1}$. Its reference to the Canidæ is not certain. (2) It seems that the species I named *Icticyon crassivultus* cannot be placed in *Icticyon* on account of an important difference in the dental formula. It must be considered typical of a new genus which I will call *Oligobunis*, and compare its characters with those of *Icticyon* as follows: *Oligobunis*, I. $\frac{3}{3}$; C. $\frac{1}{1}$; Pm. $\frac{4}{4}$; M. $\frac{1}{2}$; an internal tubercle of the inferior sectorial, which has a basin-shaped heel; *Icticyon*, I. $\frac{3}{3}$; C. $\frac{1}{1}$; Pm. $\frac{4}{4}$; M. $\frac{2}{2}$; no internal tubercle of the inferior sectorial, which has a trenchant heel—*E. D. Cope.*

Reinsch's Microscopic Investigations of the Structure of Coal.[1]—Whilst there is a general agreement among geologists that the coal of all geological formations is of vegetable origin,

[1] *Neue Untersuchungen ueber die Microstructur der Steinkohle des Carbon, der Dyas und Trias.* Von Paulus Friedrich Reinsch. Mit 94 lithographirten Tafeln. Leipzig, T. O. Wiegel, 1881.

there have been contentions from time to time, in the literature, as to the mode of accumulation of such immense masses of vegetable material, and as to the species of plants furnishing it. In his book on Chemical Geology, 1861, Dr. Fred Mohr argues forcibly in favor of the hypothesis that the massing together of marine algæ, or seaweeds, in bays by oceanic currents will account for many otherwise inexplicable occurrences of coal beds. This view, however, was unable to gain a foothold against the botanical evidence furnished by the fossil plants so beautifully preserved in the slates overlying the coal beds, and which are terrestrial plants exclusively, belonging to much higher organized families than the algæ. The frequent occurrence, too, of whole fossil forests of Sigillarids and Lepidodendroids, rooting in the underclay and penetrating the coal beds at right angles, are as many evidences for the swamp hypothesis. Thus far no internal evidence had been furnished, that is to say the structure of the coal itself had not been made a part of the argument on either side. This is owing to peculiar mechanical difficulties connected with the preparation of microscopic sections of coal. Thus, whilst many industrious observers have examined sections and noticed the presence of organic structure, no one has ventured to interpret what he saw, botanically, because nothing can be seen distinctly unless the cutting of the section be proceeded with in a certain way. At this point Professor Reinsch steps up with the beautiful work now before us. He tells of his microscopic work upon the metamorphic limestones of the Huronion, *i. e.*, the Eozoōn Canadense, the quartz schists and the hornstone concretions of the Silurian limestones of Ohio; and how he then turned his attention upon the coal, and with the previously gained experience, soon obtained such remarkable results, that the apparent hopelessness of getting satisfaction from the serpentinized and silicified structures, was turned into exultation by the carbonized material. Here there could be no more doubts, whether the things seen under the microscope were sedimentary, concretionary or crystalline or organized structures. The results and conclusions of Professor Reinsch's work may be summed up as follows:

1. *Preparation of the Sections.*—A plane cut as in rock and mineral sections, generally is not serviceable; the cut must be made in relief. Thus only the different forms can be brought out, as according to their hardness each form will become more or less transparent, since the softest parts will be worn faster and hence be finally thinner and more transparent than the more resisting forms. Sections parallel to the bedding are made without difficulty. Not so sections at right angle. Much precaution is to be exerted with these. Cut the raw plate with a steel saw 4 mm. thick, 15 mm. square. Make a plane cut as usually in rock sections, but using only the finest emery (polishing emery) or precipitated carbonate of calcium. Then rub the surface gently

in all directions with a cork plate (perfectly soft and no grains) 10 mm. square and moistened with a drop of glycerine. This treatment produces the relief. Frequent examinations must be made under the microscope, to observe the point where the desired transparency has been reached (not less than 0.01 mm.). In some cases as for Trichites and Grammites it is best to warm the raw plate and saturate it with a mixture of wax and paraffine. When attaching the plate to the support, it should neither be heated very long with the balsam nor too short a time; the first excess causing the plate to warp, crack, and inducing a partial alteration of some of the coal constituents; too little boiling causes the plate to detach itself from the support during the process of grinding. Chemical treatment with acids or alkalies is not advisable.

A microscopic image of the condition of things in a coal section may be had by closely inspecting a sharp cut through a compressed ball of hay. Here the innumerable plant individuals are cut in every direction. The different sections of the same plant have often so little in common, that an identification of the species is extremely difficult. This is true of a microscopic coal section, and only the comparison of very many specimens will establish the common characters of the forms. Prof. Reinsch's conclusions are drawn from 1200 perfect sections.

2. The organic forms of the coal consist of Protophytæ. That is, plants without distinct cell structure, with sporadic enclosures of spores and tissue fragments of cryptogamous and still higher plants. The analogous forms of the present time being Bacterium, Vibrio, Asterothrix, Protoleptis, Zoöglœa, etc.

3. These forms constitute seven generic types (thus far) in a lower and higher order.

A. Naked Plasma, forming indefinitely outlined bodies, without indication of an exterior wall.

I. *Racostromidæ.* Plasmatic thalloms, stronger trunks branching into many connected branchlets. Substance uniform, without celluloid structure. (Color in section, brown red to deep purplish red, semi-transparent.)

II. *Trichodidæ.* Trichomic plasma, running into numerous capillary ramifications. Separation of the plasma into two substances indicated.

III. *Grammitoidæ.* Plasmic thalloms composed of a honeycomb web. No cells. Uniform opaque substance.

IV. *Asterophragmidæ.* Plasmatic thalloms resembling Racostromium, but whose substance is connected with radially arranged spheres, composed of centrogranular, polarizing granules.

V. *Blastophragmidæ.* Trichoid plasma forming Trichomata, from whose granular substance polarizing spheres are formed, as in Asterophragmium.

B. The plasma forms definitely outlined bodies with an indication of external wall.

VI. *Plasmidæ.* The thalloid plasma is not yet clearly outlined by an external wall, but is composed of a granular, or fibrillary substance from which primary cells are developed.

VII. *Chroococcidæ.* The plasmatic body has become a cell, surrounded by an external wall not fully developed.

Of these types, fifty-two specific forms are described in the book, and richly illustrated with admirable drawings, without whose assistance a description is not intelligible.

4. From the great rapidity with which, under proper surroundings, the Bacteria and even the fresh-water Desmids grow and multiply, the considerable thickness of strata which the siliceous cells of the latter accumulate in a few years, there is no longer difficulty in the way of understanding the formation of coal beds now, nor the absence of microscopic structure in all true coals, nor their compactness. For pressure alone is amply sufficient to produce this density. Nor is the difference in chemical composition of various coals now so much astonishing, since this will depend on the composition of the predominating protophytes of the stratum. However, these points are not investigated yet, as indeed the whole study has not advanced beyond the establishment of a few fundamental theses. Professor Reinsch does not expect a rapid acceptation of his views, but he desires stimulating capable observers everywhere, to carry the light of science into this dark field of hereditary beliefs.

In conclusion, we would heartily congratulate Prof. Reinsch for this invigorating contribution to geology, in the prosecution of which upon our vast carboniferous areas, botanists and chemical geologists should join hands.—*George A. König.*

Geological News.—Dr. Alpheus Hyatt has published his researches on the forms of *Planorbis* found in the Tertiary beds of Steinheim. The variations are extraordinary, and furnish important evidence for the evolutionist.——Neumayr and Uhlig publish an extensive and well illustrated paper on the Ammonites of the "Hilsbildungen" of North Germany, in the last number of the *Palæontographica.*——Professor H. A. Nicholson, of Edinburgh, publishes a handsomely illustrated volume on the possibly polypoid group of the *Monticuliporidæ.*——Mr. S. A. Miller has recently described some additional species of the interesting genus *Myelodactylus* Hall.——Professor Cope has published in the Proceedings of the American Philosophical Society, the cuts illustrating the Permian vertebrata described in his Paleontological Bulletin, No. 32. The genera illustrated are *Eryops*, *Cricotus*, *Empedias* (= *Empedocles* nom. praeocc.) and *Dimetrodon.*

GEOGRAPHY AND TRAVELS.[1]

Important Discoveries in South America.—In the Naturalist for April, 1879, mention was made of the departure of Dr. Edwin R. Heath, of Wisconsin, from New York, in November, 1878, for a journey of exploration along the Beni and Madre de Dios rivers, in Brazil. He proposed to continue the work of the late Professor Orton, so sadly interrupted by his death. The *Kansas City Review of Science* for April, contains an interesting account of the success of Dr. Heath's expedition. He has ex-

[1] Edited by Ellis H. Yarnall, Philadelphia.

plored the Beni and made very valuable additions to our knowledge of this heretofore almost unknown region.

Dr. Heath writes from Reyes, Bolivia, December 20, 1880: "The question of the Beni is solved. The work of Professor Orton is finished. I made the trip from Cabinas (rubber camps on the Madidi) in a canoe with two Indians. I left Cabinas September 27th, and after delays from sickness of my men, at 8 A.M., October 8th, discovered a new river entering from the south, and at mid-day of the 8th, arrived at the junction of the Madre de Dios with the Beni. No other white man has ever seen the mouth of this magnificent river. Crude measurement gave 735 feet for the width of the Beni, and 2350 for that of the Madre de Dios. Took careful observations for latitude and longitude. At 6.50 A. M. of the 9th, I passed the mouth of a river the size of the Yacuma, entering from the north, to which I gave the name Orton. At night we slept on a sand bar joined to a large island. On the 10th we passed this island, and at 8 A. M. another large one, and at 10 A. M. came to a line of rocks obstructing the river and making rapids. One mile further down we came to the main fall, which exhibits a perpendicular descent of the entire river of thirty feet. We occupied the remainder of the 10th in drawing our little craft over the rocks to the water below. With much risk we passed the waves below the falls and camped. On the morning of October 11, we passed some rocks in the river corresponding to the rapids of the Palo Grande of the River Mamoré, but which here offer no serious obstructions to navigation. At 10 A. M., October 11, 1880, we arrived at the mouth of the Beni —that is, at the junction of the Beni and Mamoré Rivers. From thence we ascended the Mamoré, three hundred miles, to Exaltacion and Santa Ana to this place, two hundred miles west over the pampas; brought my boat on an ox cart.

"Here I am safe and sound with a map of three rivers—Beni, Mamoré and Yacuma. From the River Madidi to the mouth of the Beni, there are but four families of Pacavara Indians in the place of 'multitudes of man-eating savages,' as every man, woman and child in Bolivia has believed during many score of years. Rubber gatherers are already taking advantage of my exploration, and have established camps further down the Beni."

On account of superstitious fear of the unexplored portion of the River Beni, the productions of the rubber camps on the River Madidi have ascended the River Beni two hundred miles to Reyes, thence east two hundred miles to River Mamoré, thence three hundred miles north to its union with the Beni—seven hundred miles around, in place of less than three hundred miles direct. The waters of the Beni come down from the gold mines of Bolivia, and through forests of cinchona trees, and those of the Madre de Dios from a much larger area of similar territory of Peru.

"Dr. Heath," writes Professor Parker in the *Kansas City Review*, "alone, unaided, spent two years in patient, determined preparation near the scene of the proposed exploration, and then, in a frail canoe, with only two Indian servants, with certain death before them, as all Bolivia believed, paddled bravely forth to explore a great river and extensive country, where during 350 years, a score of costly expeditions have disastrously failed. It is thought that the governments of Peru and Bolivia will give official recognition of his daring and successful achievement. His work will develop and change the commerce of many hundred miles of mountain and plain. Rubber and bark will now descend the Beni instead of going six or seven hundred miles around."

FRANZ-JOSEF LAND REVISITED. II.—We extract from a paper prepared and read before the Royal Geographical Society, by Mr. C. R. Markham, the following additional information concerning the geology of the land visited by Mr. Leigh Smith.[1]

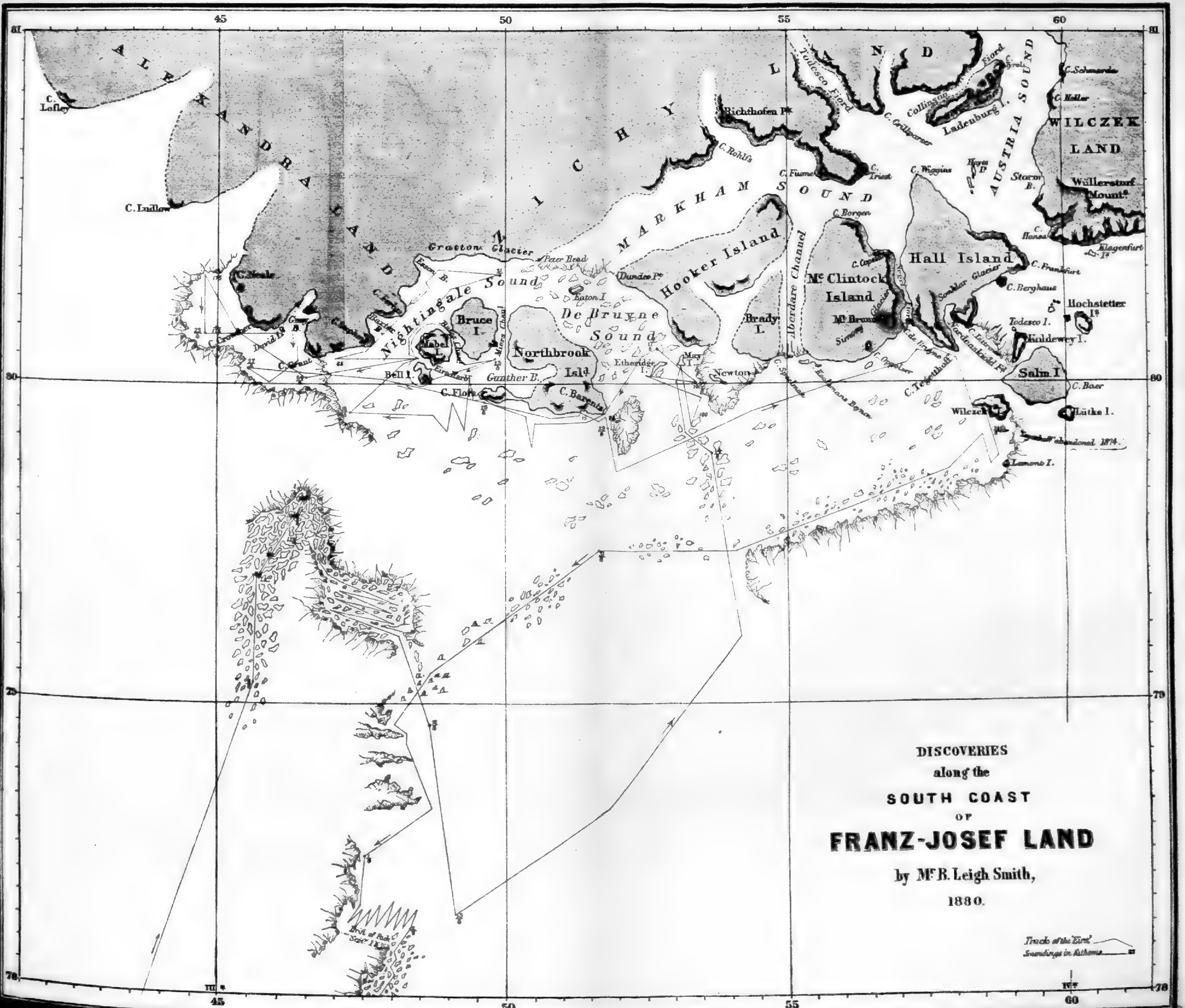
"The lowest rocks belong to the Oxford clay, and are represented, in the collection brought home in the *Eira*, by two belemnites. Above the Oxford clay the rock is of the cretaceous period, to which the fossil coniferous wood belongs, including one very perfect cone. There are also slabs with impressions of plants. Over all there has been an overflow of basalt and lava forming a cap, as on the Island of Disco. The collection of fossils brought home by Captain Markham from Novaya Zemlya, proved the existence of carboniferous rocks there, which dip under the more recent formations of Franz-Josef Land. Exactly the same carboniferous fossils were found by Sir George Nares Expedition at Cape Joseph Henry; and these discoveries point to the probable existence of a carboniferous series of rocks in the unknown region nearer the Pole, on which the cretaceous rocks of Franz-Josef Land are resting. The complete geological examination of the unknown region is one out of many important results to be derived from further Polar discovery."

Mr. Markham also speaks of the collection of invertebrate animals found in the sea on the coast of this newly discovered land. Among the Crustacea is "a new genus of Pycnogonida, or sea spiders, a really very interesting form which has never been described before," and which Mr. Miers, writing in the *Annals and Magazine of Natural History*, has named *Anomorhynchus smithii*, after its discoverer. "These sea spiders are found in the British seas of very small size. The large ones have been collected in the Kara Sea; but this new genus is peculiar to the sea of Franz-Josef Land."

In our narrative[2] of Mr. Smith's voyage, we took from the London *Times* a notice of a "can" being seen on Wilczek Island,

[1] Proceedings of the Royal Geographical Society, March, 1881.

[2] NATURALIST, March, 1881, p. 254.


DISCOVERIES
along the
SOUTH COAST
OF
FRANZ-JOSEF LAND
by Mr B. Leigh Smith,
1880.
ALEXANDRA LAND
ZICHY LAND
WILCZEK LAND
MARKHAM SOUND
AUSTRIA SOUND
Nightingale Sound
De Bruyne Sound
Hooker Island
McClintock Island
Hall Island
Bruce I.
Mabel I.
Northbrook Isld
Brady I.
Salm I.
Aberdare Channel
Gratton Glacier
C. Lofley
C. Ludlow
C. Neale
C. Crowther
C. Grant
C. Flora
C. Barents
C. Tegetthoff
C. Frankfurt
C. Berghaus
C. Baer
C. Schmarda
C. Heller
C. Wiggins
C. Borgen
C. Triest
C. Fiume
C. Rohlfs
C. Grillparzer
Richthofen Pk
Todesco Fiord
Collinson Fiord
Ladenburg I.
Wüllerstorf Mount.
Storm B.
Hochstetter Is
Koldewey I.
Lütke I.
Lamont I.
Wilczek I.
Newton
Etheridge I.
May I.
Eaton I.
Dundee Pt
Peter Head
Bell I.
Gunther B.
Eaton B.
David Id
Todesco I.
Klagenfurt
Track of the Eira
Soundings in fathoms
45
50
55
60
81
80
79
78

but it should have been, it now appears, a *cairn* erected by the Austrian expedition.

In the interesting discussion which followed the reading of this paper, Captain Sir George Nares said, in the course of his remarks: "From Payer's voyage it was learned that the Arctic migratory sea-birds went to Franz-Josef Land earlier than to any known spot. The precise reason for this has not yet been ascertained, but it afforded evidence that the water in the channels that Payer traveled over always thawed earlier in the summer than in other parts of the Arctic seas very much further south. This must be in consequence of some very strong current pouring through the strait represented in the chart, thawing the ice. He could not think that this current flowed from the south; if it did it would carry the ice towards the land, and there could not possibly be such a large quantity of water there. He therefore reasoned that the current came from the north, causing a large body of water close to the land by forcing the ice south; a vessel bound north would meet this ice at a distance from the land, and would have to force her way through it." "Mr. Markham has referred to the heavy icebergs that were born there. What became of them was not known. If his conclusion about the northern current was correct, this, in combination with a movement towards the north-west of a lower stratum of warmer water, would carry them towards Wiche's Land, of which nothing was known. They were not found drifting down past Hope Island and Bear Island in any great quantities, and it was still uncertain where they went."

Mr. Etheridge, F.R.S. (President of the Geological Society) said: "Amongst the few specimens which Mr. Leigh Smith had brought, were two or three of what appeared to be distinctly coniferous wood. To settle the age of that wood was a very important question. Was it Eocene, Cretaceous, Tertiary or any other age? After very careful examination of the cone which had been brought home, Mr. Carruthers had no doubt whatever that it belonged to the true genus Pinus. There were but two pines now known in the Siberian area, the *Pinus sembra* and *Pinus pallasiana*. No other fossil plant-remains had been brought from that region, but he had no doubt that it was Upper Cretaceous. That settled the question of the existence of Cretaceous rocks and fossils there. Beneath the Cretaceous zone there was, undoubtedly, Oxford clay, which was one of the most important formations in Great Britain and Russia. Beneath that again were older rocks still. A great deal had been done with regard to the groups of Palæozoic rocks in the northern regions, especially through Sir George Nares and Captain Fielding, who secured a fine collection of fossil Mollusca and corals. Captain Markham's investigation of Novaya Zemlya had proved the existence, in that island, of carboniferous rocks, agreeing closely with those of the Pennine chain. Probably from Petchora Land to Spitzbergen was once continuous land. Sir Roderick Murchison had proved the existence of carboniferous rocks in Petchora Land and the Ural chain, but until he himself examined the specimens from Novaya Zemlya, they were not known to exist in that island. Since Sir George Nares returned, the complete flora of those parts had been described; but unfortunately nothing had been done on the northern coast of Greenland to the eastward, and an exploration of that district and of Franz-Josef Land would give clearer information as to the geological history of the Polar regions, which he felt certain were largely composed of carboniferous rocks. By placing the several acquisitions together and comparing notes on the Ural chain, Petchora Land, Novaya Zemlya, Franz-Josef Land, and Spitzbergen, a complete history could be obtained of those rocks which stretched away to the north of Asia and America."

"The great bulk of the collection brought home by Sir George Nares was carboniferous, but the coal found was of Miocene age and thirty feet thick. No one could doubt this if he knew the plants contained in the shales, &c." * * * * "In the whole region examined by Sir George Nares, none of the carboniferous corals discovered could have lived in water less than 77°, 78° or 80° of temperature, so that most of the rocks of which the Polar regions were composed must have been formed in tropical seas. It was well known that large Enaliosaurian reptiles (Ichthyosauri) had been found in Spitzbergen. There were other things brought back by Mr. Leigh Smith, which he (Mr. Etheridge) could not yet make out, but they appeared to him to be older still. With regard to the great lava flows, they appeared to be nine in succession, most likely occurring about the same time as that of the Giant's Causeway, in Ireland, in the Miocene period, or at about the same age as the thick bed of coal found in Smith Sound. These lava flows are perfectly horizontal for many miles, showing that their condition now was just as formerly."

THE THIRD INTERNATIONAL GEOGRAPHICAL CONGRESS.—We have received the programme of the next meeting of the Congress, to be held at Venice on September 15th of this year, and to continue to the 22d. There are three classes of members: subscribers paying fifteen francs, donors giving not less than forty francs, and honorary members nominated by the committee of arrangements. The sections of the Congress are: I. Mathematical geography, geodesy and topography. II. Hydrography. III. Physical, geological, meteorological, botanical and zoölogical geography. IV. Anthropological, ethnological and philological geography. V. Historical geography. VI. Economical, commercial and statistical geography. VII. The study, teaching and diffusion of geography. VIII. Explorations and travels.

Any language can be used by the speakers. Representatives are invited from all geographical societies. Delegates will represent different departments of the Italian Government, and it is desired that commissioners should be appointed by the Governments of other countries. Geographical societies are invited to send in suggestions of questions to be discussed.

In connection with the Congress there will be held an International Geographical Exhibition to be open during the month of September. It is divided into sections corresponding to those of the Congress as follows:

Class I.—Instruments of practical geometry. Apparatus and instruments of topography, geodesy and astronomy. Telemeters, and instruments for measuring velocity. Tables of projection and calculation. Maps exhibiting the various systems of projections. Sidereal maps; maps of triangulation and hypsometry. Original topographical charts. Publications relating to the measurement of the earth. Photographical apparatus.

Class II.—Instruments, portable and of precision, relating to hydrography. Reflectors. Chronometers, marine and pocket. Logs, leads, dredges; apparatus for deep sea sounding; thermometers for measuring the temperature at different depths; instruments for measuring tides and currents; compasses and other nautical instruments (instruments for reduction, parallel and other rulers, &c.).

Marine charts, general, coasting and special; plans of harbors and anchorages. Views of coasts. Maps of currents, winds and tides. Tables and Ephemerides for the use of astronomers and mariners. Publications relating to hydrography and maritime geography. Guides to navigation; catalogues of lighthouses, beacons, &c. Proposals for a uniform international system of buoys and beacons, and for completing the lighting of the coasts. Laying of submarine lines of telegraph

Class III.—Instruments for observing meteorological phenomena. Maps, atlases, globes representing facts relating to the dominion of physical geography and meteorology. Magnetical charts (isoclinous, isogonous and isodynamic). Charts of isobars and isotherms, &c. Maps of geological, zoölogical and botanical geography. Other publications and collections relative to this branch.

Class IV.—Maps and atlases referring to general anthropology, ethnology and comparative philology. Other publications and collections relating to these subjects. Grammars and vocabularies of languages little known; comparative studies.

Class V.—Maps and other publications of historical geography. Ancient and modern works and manuscripts relating to the history of geography. Ancient maps and globes. Instruments used by ancient geographers, astrolabes, &c.

Class VI.—Works, charts and diagrams of statistical, economic and commercial geography (population, agriculture, manufactures, commerce, public works, colonization, &c.). Collections of commercial products and objects made from a geographical point of view.

Class. VII.—Treatises and methods for instruction in geography. Outlines and landscapes. Wall maps; models and instruments for instructions in geography. Atlases and geographical dictionaries. Charts and maps of the globe, terrestrial and celestial globes. Copies of topographical charts; maps and plans in relief. Different methods of reproducing maps (photography, heliotyphy, lithography, zinçography, photolithography, chromolithography, &c.). Materials and apparatus specially used in the preparation of maps.

Class VIII.—Instruments for expeditions, astronomical determinations and topographical copies; traveling barometers and thermometers, pedometers, sextants, &c. Portable photographic apparatus, specimens of camera lucida. Route maps; sketch maps. Essays, fac-similies, reproductions and collections of every description which illustrate voyages of discovery, photographic views and drawings of countries little explored Instructions for geographical expeditions. Instruments and equipment of a traveler; portable arms, utensils, tents and medicines; portable boats; waterproof coverings and clothing; apparatus for giving light on nocturnal marches and encampments. Modes of packing and carrying on voyages of discovery. Narratives and publications of all kinds relating to geographical voyages. Publications and instruments used in Alpine climbing.

MICROSCOPY.

TEST OBJECTS. AMPLIFIER.—Why I think little of the Podura as a test, is, that it requires a skilled microscopist to appreciate it for that purpose, and a skilled microscopist can judge of the value of a lens by its performance on any object. Test-objects are of most use to a beginner, and if he does not know exactly what he ought to see, a skilled showman can make them both a delusion and a snare.

I might perhaps add to the working distance question that a concave lens inserted in the body of the microscope as an amplifier, will give increased working distance to any objective, and if we have to deal with a cover just too thick to focus through without it, the insertion of the concave will enable us to focus through at once—within limits, of course. If a flint lens, it does not much interfere with definition, and is sometimes of use to overcome the difficulty.—*Edwin Holmes in English Mechanic and World of Science.*

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SCIENTIFIC NEWS.

— Dr. James Lewis, the well-known conchologist, died of apoplexy, at his home at Mohawk, N. Y., February 23, 1881. He was born at Schuyler's lake, Otsego Co., New York, in July, 1822. He was, therefore, nearly 59 years of age at the time of his death. Like many another who has become distinguished in natural science, his earlier education was confined chiefly to the common school. At the age of twenty-four he began to read medicine, and prosecuted his studies for some three years, when he became interested in dentistry, and abandoning the broad field of general medicine, devoted himself to this special branch of medical science. For this he was eminently fitted by his great mechanical skill, and to the implements employed in his art he contributed many permanently valuable improvements. It is as a naturalist that we have to consider Dr. Lewis. He became interested in nature in his childhood, and that interest deepened with years into admiration, and admiration into love, which led him to intelligent, untiring pursuit. It was while he resided in Boston, Massachusetts, from 1849 to 1851 that he became interested in his favorite science and formed the nucleus of what was to become one of the most valuable private collections of American land and fresh-water shells extant. From that time until a year or two previous to his death, he was a most devoted student and untiring enthusiastic collector. He is widely known to the authorities in the science he cultivated by a very extensive correspondence, of which art Dr. Lewis was certainly a master. Within the scope of his acquaintance are embraced all the living names familiar to the younger naturalists, and many others who have passed away. His published works, when the magnitude of his labors and the opportunities they have presented are considered, have not been many, but all published possess permanent value. They date from 1854, and number some eleven titles. The first consists of notes on "*Alas.* (*Marg*) *marginata*," published in 1854. In 1856 he published three papers, two in the Proc. Bos. Soc. Nat. Hist. and one in the Proc. Acad. Nat. Sci., all relating to the Mollusca of the State of New York, and two of them are local lists, with notes. In 1857 he published a single paper "On Erosion of Uniones," in Proc. Bos. Soc. Nat. Hist. In 1860, two papers, one on "Colors of Unionidæ," and the other a local list, both of which appeared in the Proc. Acad. Nat. Sciences of Philadelphia. He published nothing further until 1868, when appeared a paper in the *Am. Jour. of Conchology*, "On the Mollusks of the Mohawk valley." In 1869, in the same journal, he published a valuable paper "On the Shells of the Coosa river," Alabama. The bibliography and indices of Dr. Lea's "Synopsis of the Unionidæ" next engaged his attention, and they are, in great part, largely arranged by him. His last published work of value appears in the Geological Report of Alabama for 1875(?), and contains the almost complete geographical distribution, by streams, of the shells of that State. Some very suggestive remarks are likewise appended as notes to the work which he has there performed. He was also an occasional contributor to the NATURALIST. The major part of his life's work remains behind him in the form of MSS., many of which had they been published, would add largely to our knowledge of fresh-water forms. The most of these have passed into the hands of my collaborateur, Mr. A. F. Gray. The great work of Dr. Lewis was as a systematist. In this field he was an acknowledged master, and here his services were frequently required by individuals and freely given. He arranged and classified many public collections, among which were the American fresh-water shells in the Smithsonian Institution, the last critical revision of which was made by him; the collection of the Buffalo Acad. of Nat. Sci., those of Vassar College, Mount Holyoke Seminary, Wellesley and Hamilton Colleges, and the State Cabinet at Albany. The examination of these extensive collections furnished him with material for the determination of synonomy, which, had he lived to complete it, would have very greatly reduced the number of acknowledged species. In work of this character he was truly philosophic, and his opinions commanded and obtained respect. The great changes in scientific thought occasioned by the doctrines of evolution, found an ardent advocate in him, and those great principles formed the basis of all his later work. He has often remarked, and repeated it to others in his correspondence, that the great work of the future would be done from this standpoint, and "much remains to be done in eradicating the errors of the older naturalists." He was a conscientious worker, an acute thinker, and a man of great research. In the prosecution of his studies he was indefatigable, and here was the cause of his disease—a nervous disorder which reached its climax in his death. He lived but five hours after the apoplectic stroke, and died without regaining consciousness. His merits were recognized by various scientific societies in electing him to a membership, among which were the Philadelphia Academy, the Boston Society Nat. Hist., the American Association for the Advancement of Science and the Buffalo Academy. To the publications of all these he was a contributor. In his death science loses a man of no ostentation, but of patient and painstaking endeavor; in manner he was reserved at times, but always gentlemanly and courteous; he was single in his purpose, and devoted in pursuit of his objects. It is with a deep sense of personal loss that these lines are penned in memory of one who was universally kind and helpful; a kindness and helpfulness that many another has shared time and again at the hands of Dr. Lewis; advice was always freely given, nor was aid ever denied when aid was needed. His death is a loss to American science that all will deplore.—*R. E. C.*

— The working naturalists of Des Moines have recently organized as a working body, adopting as the style of the organization, "The Agassiz Field Club," the leading idea of which is therein set forth. Articles of incorporation were filed in the latter part of April. The club is composed of specialists in various branches of natural science, and limits the membership to twenty-five, some extended acquaintance with some branch or another being a necessary antecedent to an election. Three directors were chosen, Messrs J. A. Jackson, Professor L. B. Cary and Wallace Bailey. At the formal organization, Rev. Dr. C. A. Pomeroy was chosen president, and Professor R. Ellsworth Call, corresponding and recording secretary. The club will publish any results reached which may prove of sufficient value, in the form of occasional Bulletins. It proposes, ultimately, to work up the natural history of the entire State—a thing long and sadly needed. Aside from occasional local contributions, made by individuals and at little expense save to themselves, nothing has been done in this State, and the field is open still to investigation. Dr. Parry has alone done much in its botany, Mr. J. A. Allen in its ornithology and mammalogy, and there the natural history work ends. Twice has the General Assembly instituted a geological survey, and as often brought them to an abrupt ending. The survey of Professor James Hall, from 1855–1860, resulted in the gathering of a vast amount of material which has never been in full worked up and described.[1] The General Assembly, after receiving and distributing the volumes published in 1858, containing a partial account of the material obtained, and with the evidence of progress before them in a printed supplement, with maps, sections,

[1] Dr. Hall has since described and illustrated a large number of these forms in the Annual Reports N. Y. State Cabinet of Natural History. But there are now many of them, rare and costly, and beyond the reach of the student.—*R. E. C.*

&c., of portions of the coal field, prepared for publication, not only refused to publish or go on with the field work, but refused to refund to the principal geologist the salaries of his assistants, and expenses of the survey for the preceding year, which he had advanced from his own means, or to pay for his own services during that time; all of which to this day remains unpaid. This was not only dishonest but foolish—dishonest, because repudiating a just debt; foolish, because a continuance of the survey meant a clearer insight into the riches of the great State for whose highest interests they were sent to legislate. Then came the survey of Dr. White, the results of which, in an imperfect form, were ordered printed despite the protests of the geologist, and the survey again brought to a close. The complete geology of the State is still unknown. Many thousands of dollars are being expended in the counties of Page, Fremont, Mills and Montgomery, in a vain attempt to find coal. The survey of Dr. White, incomplete as it necessarily was, had demonstrated that no coal could be obtained in that portion of the State, at a distance from the surface to prove remunerative. Personal observations confirm the accuracy of his judgment. So the field is still open, and the various societies in the State might apportion it into districts, convenient to the seat of each, and accomplish a work which a short-sighted legislature declared useless. There are local geologists of some reputation in Iowa, and they could thoroughly and completely perform the work.—*R. E. C.*

— An important memoir on the crustaceans of the Caribbean sea and the Gulf of Mexico, has been read by M. Alph. Milne-Edwards to the Paris Academy. The material he has to deal with had been sent him by Mr. Agassiz, and obtained during cruises in the *Blake*, in recent years. The author is struck with the great difference between the fauna of the coast and that of the deep parts. The shore animals are of a highly-organized type, while the deep-water animals have a more ancient character. A large number of new species have been met with, and it has often been necessary to form new generic divisions. Several groups, formerly thought foreign to American seas, have been found abundant at great depths (*e. g.* the family of Galathea). The infinite variety of forms is very remarkable, and the accepted modes of classification will often not apply. There is a large number of transition-forms. M. Milne-Edwards considers that the study of animals, living at great depths, is only begun, and he invites men of science to organized effort in a domain which is certain to prove highly fruitful.

— M. Certes has lately found a method of coloring infusoria and anatomical elements during life. Placed in a weak solution of chinoline blue or cyanine, infusoria are colored pale-blue, and many continue to live 25 and even 36 hours. Strong doses poison immediately. Again, after being 24 hours in a moist chamber, the white blood corpuscles of a frog colored with cyanine show amœboid movements. The cyanine should here be dissolved in serum. Chinoline blue is, *par excellence*, the reagent of fatty matter. By affecting the cellular and not the nuclear protoplasm in infusoria, it shows fatty matters to exist only in the former. It should prove a useful means of studying cellular life.

— The annual meeting of the Society for the Promotion of Agricultural Science will be at Cincinnati, on Tuesday, August 16, 1881, the day preceding the sessions of the American Association for the Advancement of Science.

The following gentlemen have indicated to the secretary their readiness to present essays at the coming meeting: Professor S. W. Johnson, Patrick Barry, Professor W. J. Beal—subject, Testing seeds, Professor J. Henry Comstock, Professor E. W. Hilgard, Professor R. C. Kedzie—subject, The ripening of wheat, Professor A. J. Cook, J. J. Thomas, L. B. Arnold, E. Lewis Sturtevant, M.D.

— The sixth session of the Summer School of Biology will open at the Peabody Academy of Science, Salem, Mass., July 12th, continuing for four weeks. It is designed expressly for teachers. Professor E. S. Morse, the director, will be aided by Dr. J. W. Fewkes, Dr. C. S. Minot and Professor Straight, and Messrs. Fish and Sears.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

National Academy of Sciences.—The annual meeting began in Washington, April 19, the president of the Academy, Professor W. B. Rogers, of Boston, in the chair. The list of papers read is as follows:

Tuesday, April 19.—"The domain of physiology," by T. Sterry Hunt; "The compass plant of the western prairie," by B. Alvord; "The solar constant," by S. P. Langley; "The color of the sun," by S. P. Langley; "On mountain observations" by S. P. Langley; "On the relations of soils to health," by R. Pumpelly; "Reduction to sea level of barometric observations made at elevated stations," by Elias Loomis.

Wednesday, April 20.—"On electric light photometry," by Geo. F. Barker; "On the condenser method of measuring high tension currents," by Geo. F. Barker; "On the relation between strains and impacts and the structures of the feet of mammalia," by E. D. Cope; "On the progress of pendulum work," by C. S. Peirce.

Thursday, April 21.—"On the carbon lamp fiber in the thermo-balance," by Geo. F. Barker; "Upon the production of sound by radiant energy," by A. Graham Bell; "On the later Tertiary of the Gulf of Mexico," by E. W. Hilgard; "Recent researches in the vicinity of Behring's strait, comprising, 1. An account of the land ice of Kotzebue sound and the Arctic coast; 2. Additions to our knowledge of the currents and temperature of the ocean in the vicinity of Behring's strait," by W. H. Dall; "A method for finding the proximities of the orbits of minor planets," by C. H. F. Peters: "Structure of the wings of insects, studied palæontologically," by Samuel H. Scudder; "Biographical memoir of S. S. Haldeman," by J. P. Lesley; "On the auriferous gravels of California," T. Sterry Hunt; "On the utilization of the sun's rays in heating and ventilating," by Edw. S. Morse; "Results just obtained with regard to the molecular height of hydro-fluoric acid," by J. W. Mallet.

At the executive session of Thursday, Professor A. W. Wright, of Yale College, and Professor H. A. Rowland, of Johns Hopkins University, were elected members, and the following were elected members of the council; Professor S. F. Baird, Professor Wolcott Gibbs, Cambridge; Professor A. Hall, United States Navy; Professor J. E. Hilgard, Coast Survey; Mr. Clarence King, Mr. Fairman Rogers, Philadelphia; Professor Simon Newcomb was elected home secretary, and Professor J. H. C. Coffin, United States Navy, treasurer.

Boston Society of Natural History (Section of Entomology), March 23.—Mr. Edward Burgess, of the Bussey Institution, described the structure of the pharynx in the Orthoptera, and particularly in Anabrus, where its muscular development is as well marked as in the case of the Lepidoptera. A closely similar arrangement of longitudinal and annular, or transverse, muscular layers, as well as suspensory muscles, obtain in both orders; and thus the evolution of a powerful sucking pharynx from one possessing only the ordinary function of deglutition is made easy.

Mr. Burgess spoke also of the very uniform character of the endocranium in mandibulate insects. This portion of the interior skeleton has received almost no notice, but will be found an interesting study, and its modifications throughout the hexapods deserve to be followed up.

April 6.—Professor Penhallow described the manners and customs of the Ainos of Japan, and Mr. F. Gardiner, Jr., gave an account of the work done by the U. S. Fish Commission during last summer.

April 20.—Dr. J. S. Diller read additional notes upon the felsites and associated rocks north of Boston, and Mr. J. S. Kingsley described the anatomy of a five-legged frog.

New York Academy of Sciences, New York, March 28.—The following papers were read: Notes on the fauna and flora of the gorilla region, Equatorial West Africa, by Mr. Hugo von Koppenfels; On the occurrence of *Helix aspersa* (European) in California, and the geographical distribution of certain West American land-shells, etc., by Mr. Robert E. C. Stearns.

April 4.—Mr. N. L. Britton read a paper on the geology of Richmond county (Staten Island), N. Y.

April 11.—The following paper was read: On the building and ornamental stones used in New York, with illustrations of their microscopic structure, as shown in the lantern by polarized light, by Mr. Alexis A. Julien.

May 2.—Mr. A. A. Julien presented the results of some recent observations on fluid cavities in minerals; and the president (Professor J. S. Newberry) exhibited some interesting and remarkable fossils lately received at the School of Mines.

Appalachian Mountain Club, April 14.—Professor Charles E. Hamlin read a paper entitled "Mount Ktaadn and its approaches as seen in 1879 and 1880." A newly constructed model of the mountain illustrated the paper.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

Quarterly Journal of Microscopical Science.—April. The minute anatomy of the Branchiate Echinoderms, by P. H. Carpenter. On young stages of Limnocodium and Geryonia, by E. R. Lankester. The origin and significance of the metamorphosis of Actinotrocha, by E. B. Wilson. A further contribution to the minute anatomy of the organ of Jacobson in the Guinea pig, by E. Klein. On the development of certain microscopic organisms occurring in the intestinal canal, by D. D. Cunningham. On the cause of the striation of voluntary muscular tissue, by J. B. Haycraft. On the relation of micro-organisms to disease, by J. Lister. Observations and reflections on the appendages and on the nervous system of *Apus cancriformis*, by E. R. Lankester.

The Geological Magazine.—April. Geology of British Columbia, by G. M. Dawson.

Annals and Magazine of Natural History.—March. On some new or little known Infusoria, by C. Mereschkowsky. On Synaxes, a new genus of Crustacea, by C. Spence Bate. On silicious sponge growth in the Cretaceous ocean, by Dr. Wallich. On *Spongilla cinerea*, by H. J. Carter.

American Journal of Science and Arts.—April. Monograph by Professor Marsh on the Odontornithes, or toothed birds of North America, notice by G. B. Grinnell. Elements in orographic displacement, by W. J. McGee. The basin of the Gulf of Mexico, by J. E. Hilgard. The Geology of Florida, by E. A. Smith. New order of extinct Jurassic reptiles (Cœlaria); Discovery of a fossil bird in the Jurassic of Wyoming; American Pterodactyles, by O. C. Marsh. May. Action of frost in the arrangement of superficial earthy material, by W. C. Kerr. Dall's observations on Arctic ice, and the bearing of the facts on glacial phenomena in Minnesota, by N. H. Winchell. Geology of Peace river, by G. M. Dawson. American Jurassic Dinosaurs, by O. C. Marsh.

Canadian Naturalist.—March 17. Revision of the land snails of the Palæozoic era, with descriptions of new species, by J. W. Dawson. Note on fossils from the red sandstone system of Prince Edward island, by F. Bain. On new Erian (Devonian) plants, by J. W. Dawson.

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ORIGIN AND DESCENT OF THE HUMAN BRAIN.[1]

BY S. V. CLEVENGER, M.D.

THE object of this paper is to present to comparative anatomists certain aspects in the phylogenesis of the spinal cord, which culminate in the development of the brain of man.

The word brain is here used to include only the nerves and ganglia of the skull. The term has been applied so loosely that Professor Wilder rightly advises its discontinuance from neurological nomenclature.

Briefly stated, the nerves interrelate the muscles as the muscles interrelate the bones, nerves further are internuncial in conveying external or internal molecular vibrations to irritable or contractile tissues.

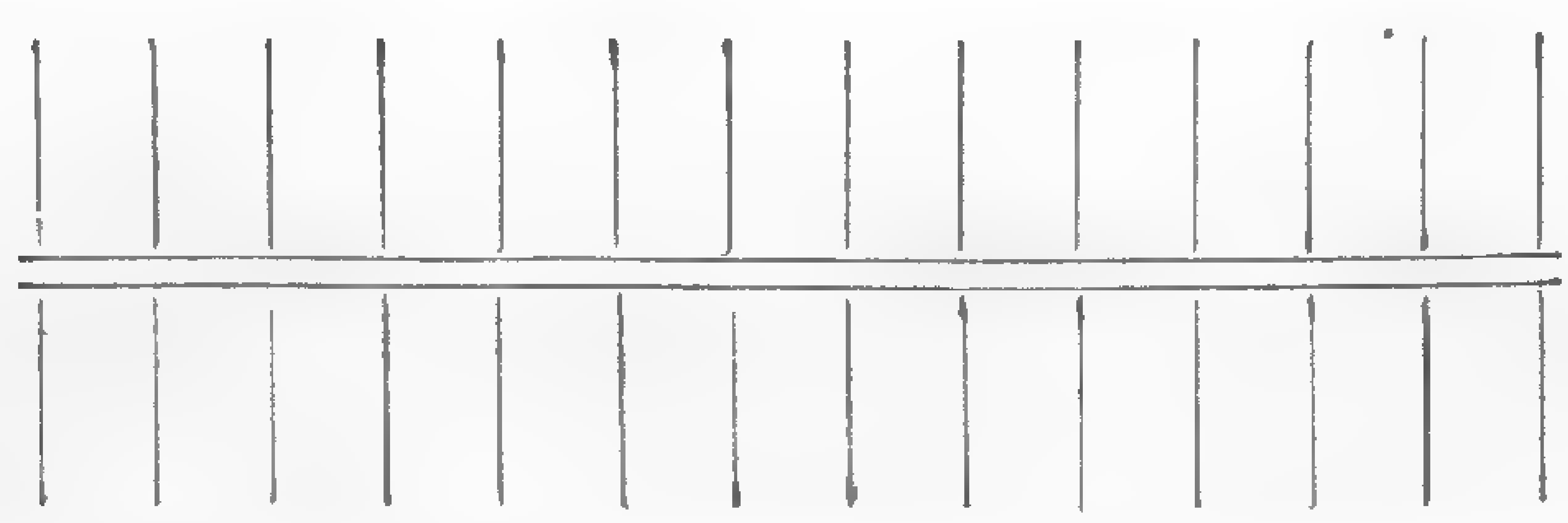
Biological investigations enable us to approach very closely the border land of sensation and molecular physics. While the physicist is striving to reduce his laws of sound, heat, light, electricity and gravitation to their ultimates, the biologist is meeting him over consideration of the forces which control the motions of the Amœba or evolve the animal from the cell.

In the Journal of the Royal Microscopical Society (Vol. III, No. 1, p. 63, from Arch. Mikr. Anat., XVII, 1879, p. 58) are diagrams of the simplest acoustic and visual cells. These forms of nerve cells proceed from a still simpler protoplasmic cell, which, according to situation or the influences brought to bear upon it,

[1] Read before the Chicago Academy of Sciences, February 8, 1881.

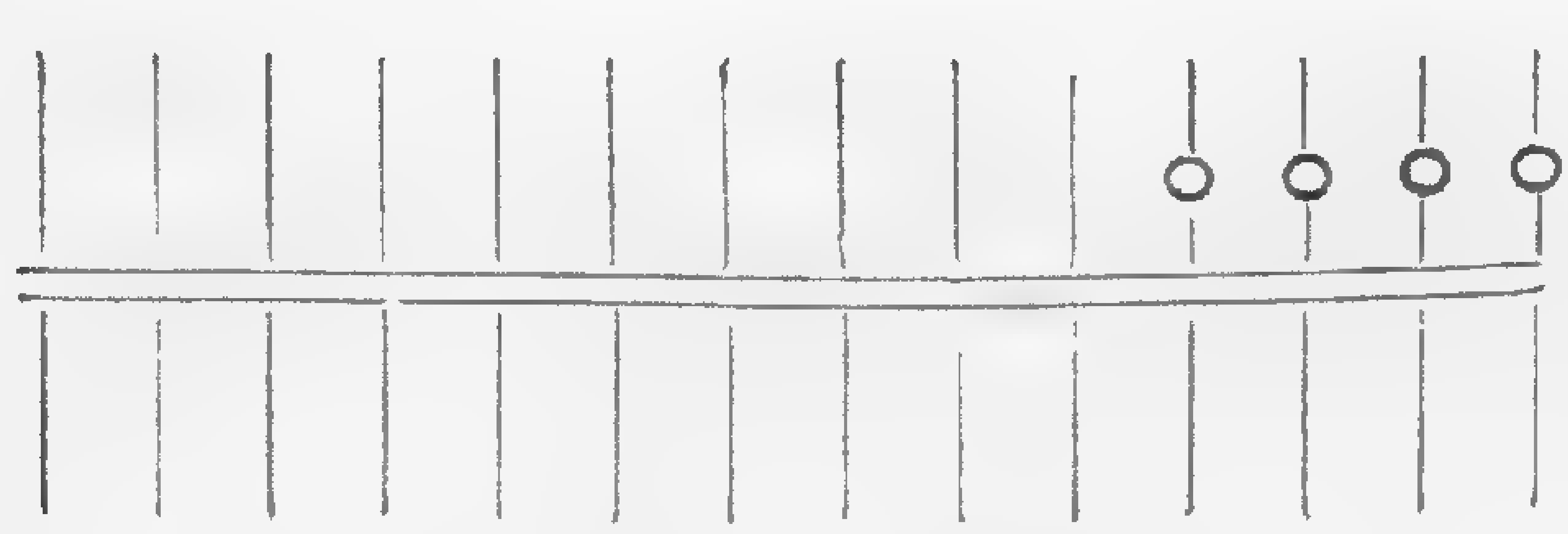
can as well develop into muscle, cartilage, cuticle or bone. It is the position of the cell and its environment which in embryology, as well as in phylogeny, determines what the cell shall become. The unity of the forces at work in nature are very evident to the biologist as well as to the physicist. But we must pass on to the main subject with the statement that after an orderly method of aggregation, certain protoplasmic cells arrange themselves along the dorsum of the embryo in the egg, and a spinal cord is formed.

The simplest spinal cord is owned by the Amphioxus, a vertebrate lower than the lamprey of our lakes. This fish-like animal has no brain. Extended the length of the body, is the cord, and nerves enter it dorsally and ventrally; the second pair of nerves of the head end pass caudally. Those along the back in this diagram are sensory, the lowermost being motor:



Owen compares these longer nerves to the nervus lateralis of the cod. He mentions them also as nerves of association comparable to the trigeminal and vagal.

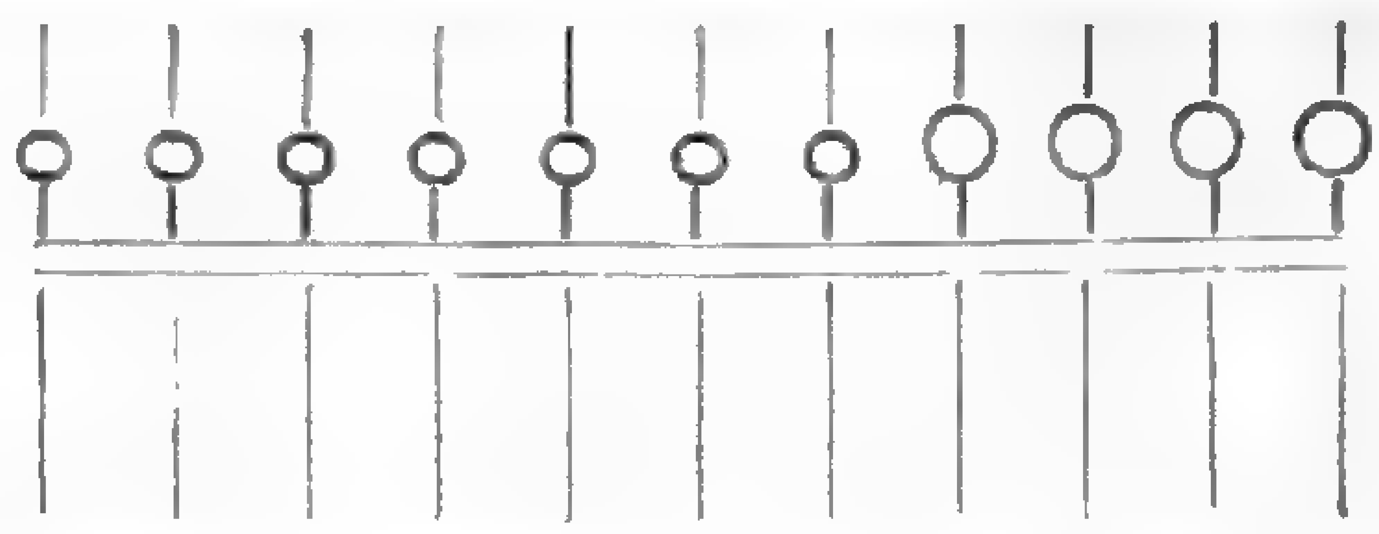
The cord of the lamprey *(Petromyzon fluviatilis)* is quite rudimentary, but a distinct brain presents itself in this case for analysis. We find certain intumescences attached to the spinal cord at the head end, which can be represented schematically thus:



The real appearance of these ganglionic swellings, for such they are, resembles the embryonic fusion of cerebral and spinal ganglia. A very important revelation concerning the homologies of these tubercles, I hope to be able to present to the next meeting of the American Neurological Society.

Notice that in this low vertebrate form, these enlargements on the sensory or ingoing nerves, occur at the head.

A Teliost, the *Trigla adriatica*, affords an example of these same enlargements appearing all along the spinal column:



(The *lateral* fusion also between these ganglia in the head end, occurs among the intervertebral in *Orthogoriscus mola.*)

Taking a general survey of the piscine and amphibian brains, we find, in many, these ganglia well defined as rounded, symmetrically placed bodies (Lepidosteus, Amblyopsis, Leuciscus), while in others these lobes are distorted, by elongation or cramping, in all directions (sturgeon, chimæra, sharks), and in still others, some of the lobes are pushed below the usual site (cod, herring, perch). Of necessity the ventricles must often be partially or wholly obliterated, showing the inexpediency of making use of ventricular passages in homologizing.

This crowding together, fusion and distortion of ganglionic lobes, obtains throughout animal life, and the olfactory lobe is often so closely fused with the prosencephalon as to afford us no line of separation. An interesting point in this connection is presented by the corpora bigemina, which lie upon the upper surface of the brain in reptiles, being succeeded in birds by these bodies being thrown down to the sides and base of the brain, crowded there by the greater relative size of the superior lobes.

The intervertebral ganglia which develop on the afferent nerves of the higher vetebrates undergo great development within the cranium, and by lateral crowding together, the median line of separation is obliterated, giving us the large central lobe of the shark and birds. Two or more of these ganglia may develop upon the same sensory strand (see Davida, *Centralblatt*, No. 26). The subsequent lateral lobes of the cerebellum can be resolved either into secondary or primary ganglia, or a mixture of both, certainly the vagus tubercle of the fox shark is in all essentials the pneumogastric lobule of man's cerebellum, the flocculus.

Thus it appears that by the pressure together of a number of these posterior spinal nerve root swellings a cerebellum has been formed. The cerebellum is now generally conceded to be a coördinator of sensation for cranial sensory nerves, and how can it be otherwise from this view? By this coalescence of intervertebral bodies it necessarily follows that sensations passing in from a variety of points must be distributed to a wider area of central points in the medulla and spinal cord. This explains why injury to the lateral lobes may occur without manifestation of the lesion and why a disorder of the central lobe or vermis produces a staggering gait. The main bundles of ingoing nerves are gathered in the latter region, while the plexus of fibers in the lateral lobes afford many avenues for impulse passage, other than those injured or destroyed. The original globular appearance of the lobes composing the cerebellum may be well made out in most quadrupedal forms, but as we pass to man we see that these lobes have become compressed into laminæ.

In a previous paper (presented to the American Association for the Advancement of Science, Boston, August 28, 1880, published in the *Journal of Nervous and Mental Disease*, October, 1880, and AMERICAN NATURALIST, January and February, 1881), I endeavored to show that all tubercles of the vertebrate brain fall within this category of intervertebral, a notable instance being the Gasserian ganglion. Mr. A. Milnes Marshall (*Monthly Microscopical Journal*, London, October, 1877), in an article "On the development of the nerves of the chick," shows plainly that the olfactory nerve must be considered homologous with spinal nerves, for it is similarly developed and in no way differs from a spinal nerve. Nor does the comparison rest here, for the lobe (not bulb) of the mammalian olfactory may be seen to be developed between the central tubular gray and the periphery just as is an invertebral. As to internal structure, the law of differentiation shows that subsequently acquired differences are not arguments against original derivation, for what can be more unlike than bone and cartilage, skull and vertebræ or hand and foot? And yet the one is a developed or differentiated condition of the other.

Thus the mammillary eminences, the epiphysis, the optic and post-optic lobes were originally intervertebral, and the olivary body embedded in the spinal gray is another related particularly to innervation of the tongue. It is very large in the parrot and has relation to the ability of that bird to articulate. But the most general interest centers in this large mass of nerve fibers and cells called the cerebrum. In the Ornithorynchus, it is smooth and simple in form, but the beaver also has an unconvoluted brain, which shows at once the folly of attaching psychological importance to the number and intricacy of folds in animal brains. With phrenology, which finds bibativeness in the mastoid process of the temporal bone and amativeness in the occipital ridge, the convolutional controversies must die out, as has the old so-called science of palmistry, which read one's fate and fortune in the skin-folds of the hand.

The most noticeable change in form, as we pass up the scale of mammalian life, occurs in the production of the fissure of Sylvius. In most quadrupeds the olfactory lobe fills up largely the anterior part of the cranium. As the smelling sense diminishes this lobe degenerates to a mere tract and the frontal lobe of the brain increases in size, lifting the forehead into a vertical plane. The medulla is pushed forward to a less oblique angle with the front of the brain, from Lemuridæ to chimpanzee and man, and the frontal lobe pressure covers the cerebellum with the backward progress of occipital, till finally the occipital forms the temporal by curling under and forwards, forming the Sylvian fissure. These stages of progress are evident in the horse, elephant and human embryo. Often, in idiots, we find through want of development of this frontal lobe, that ossification takes place in a plane inclined at an angle corresponding with that of lower animals, and the cerebellum is uncovered. This is an adaptation of the skull to its contents, which, however, does not always take place. There are other elements at work to cause the skull to develop normally or even enlarge it abnormally, as for example, an accumulation of water in the ventricles will change the relative positions of the cranial bones to such an extent as to give to the hydrocephalic idiot the "front of Jove."

While the ontogenetic stages of development resemble strikingly the forms mentioned by Haeckel, the nervous system is not apparent in the embryo until we reach the ninth stage or Acranial, after this the cerebral vesicles rapidly develop and resemble in general the Cyclostome stage, and just as the sharks and mud fishes possess the intervertebral ganglia, which the hags and lampreys have not, the human fœtus, subsequent to the shaping of the cerebral vesicles, develops the posterior spinal nerve root swellings. From this point upward, it is easy enough to observe, that like the brains of marsupial adults, the cerebellum is at first uncovered, then by frontal lobe growth the temporal lobe is formed as in Simiadæ.

THE EASTERN SNOW-BIRD.

BY REV. SAMUEL LOCKWOOD, PH.D.

FOR New Jersey, so severe was last winter, that appeal is made to "the oldest inhabitant" to adduce a similar experience. As is usual with this mythical "Old Prob.," he fails to cite an instance. Albeit the pure white of her "wrap," nature in her snowy deshabille is not altogether lovely. In truth, many of her admirers, with a shiver, withdraw from their open-air converse to a fire-side communion. It is all very well to talk of coasting and skating, and to get into high jinks about "the tintinnabulation of the bells," meaning that excruciating jangle, yclept "sleigh music," which has no music in it, unless we thus dignify the sonorously uproarious "gling! glang! glorious!" of that Teuton, Hans Breitmann. It may be as a dull man we prefer a toot on a gentler even if sadder strain. Leaving out the pangs of poverty, what shall be said of the keen suffering attendant on out-of-door industry, when exposure is so pitiless on man and beast! And yet this general nudeness is not without advantage of a weird sort to the true naturalist, because of a certain transparency which whets the faculties, imparting edge to curiosity and precision to observation. All things seem open. The very atmosphere is in sympathy with the naked truth—and even the trees, from bole to spray, become on a sudden crystalline. The sight is sharper and the hearing keener, and both are farther reaching. Last Lord's Day morning, January 30th, the air was pure, bright and still, and the timbre of our village church bells seemed peculiarly fresh, as they pealed forth the hebdomadal summons in the pure frosty breath of their brazen throats. Though walking briskly, the church-goer looked more thoughtful. He felt himself possessed of an almost mysterious enlargement and refinement of the senses; for he heard with startling distinctness the church bell of a hamlet fully five miles away to the east, and with equal clearness his ears took in the sound of another church bell from a village as far away to the west. It was observable, too, that both rang in the same tone—but that the ringing at the east was set eight notes, or a full octave higher, than that at the west. Did the one think herself eight strides the nearer to churchly perfection? But fie! Why seek to revive a point so mooted by the oriental and occidental churches?

But how obliging has nature become, that she allows a convalescent to interview her from his study windows. Yes, and her coyness breaks down too, for she lets out some of the esoteric ways of her winter birds. After falling many hours, the snow stops, and a cold clear blue sky opens over head. A flock of snow-birds has come. They seem to be the living feathery fringe on the skirts of the snow storm. And what a relief these pretty birds impart. This nival covering is not a shroud to conceal the dead, but a warm comforter spread over earth's slumbering forces by that Great, Good Hand "which giveth snow like wool." In easy view from my library windows is a spot in the headland of the old orchard, where last autumn grew a tall *Phytolacca decandra.* The tip of the dead plant is but just exposed, and that is hint enough to the little fellows that the dried currant-like berries of the pokewort are to be found in a natural cache under the snow. The way in which a group of five or six birds keep at the spot would indicate that the placer "pans out well." How they do dig down into the snow! Dig? Yes, though, very un-bird-like, that is the right word, for it is altogether unlike scratching. Its method of mining, for a bird, seems to me to be original. Our *Junco hyemalis* is a hopper, not a runner, and scratching is, as a rule, not an accomplishment of the hopper family. In truth, you can't bring the hoppers up to the scratch any way. Still our snow-bird is great on push—he does shove things; and a queer shove it is. I am almost afraid to attempt a description. The bird stiffens out its toes, then makes a jumping shove forward and upward, thus lifting and flirting the snow. The movement is of the whole body, and the action is scooping, not unlike that of a ditcher. It is not a shuffling motion, for it demands too much dexterity, but a true shoveling movement. Like the post-hole digger's shovel with its short blade and long handle, the middle toe of Junco is shorter than its tarsus.

Soon this natural cache was exhausted, and a deep, wide excavation with a small entrance was the result of their patient digging. It was truly a snow cavern. The birds soon learned to feed from a supply put at their service on the window sill. Finding so good a commissariat, they sojourned with us a number of days, the little bevy of not more than seven, keeping always together, as if by a family compact. Indeed, this is a pretty domestic feature of our eastern snow-bird. Some twenty-five feet from our study windows is a beautiful copse of *Thuja occidentalis*, or arbor vitæ, its object being to screen an outhouse from the public road. The trees are high and the foliage dense, and each tree hugs its companion lovingly, so that all seem but as one. Hither come our little birds when the day's foraging is done—this is their nightly "covert from storm and rain;" while strange to tell, their snow dug-out is made to serve as a cosy asylum from the cutting wind by day. A callow philosopher to whom the above was mentioned, pronounced it a probable instance of mimicry inherited from a very ancient Junco, who got the idea from that glacial Eskimo who made snow dug-outs in Central New Jersey. The suggestion was declined, with thanks, but our speculative friend seemed much graveled about it. Nor did the counter suggestion mollify matters—that snow-house building required some architectural skill. We even urged the fact of its form, a segment of a sphere, and further that as a true surbased dome, this igloo of these Innuits greatly antedated that famous dome of the Parthenon, yet were less ancient than the dug-out domiciles made by mollusks, insects, birds and beasts.

There are always to be found the ne'er-do-wells among both birds and men. The survivals generally are such as anticipate the untoward times. We hear of the imported sparrows stuffing their boxes to exclude the cold; and we saw in an elm tree in the village, a nest which they had made of coarse materials, almost large enough for a hawk, the simple carrying labor for which must have been prodigious. But among these little folks, this providing for a rainy day is exceptional. It does not indicate the tribal habit so much as the individual capacity. I did not see any other Juncos improvise a snow dug-out into a shelter from the storm. With many birds it is a common practice to avail themselves of the handiwork of man. My daily paper reads: "During the recent cold weather a flock of snow-birds took refuge from the cold in Margaret English's barn at Smith's Landing, and became very tame." We trust that the good Madam, like a pearl of a woman, gave the wee birdies food. "Became very tame." This tail end of that local item wags more gravely than the writer knew. This tameness of the snow-bird is only in winter born, and comes of pitiless pinching pain. The food supply withdrawn they come timidly to our doors. And how delightful it is that one may turn his window sill into an almonry for the winter birds—to us and them, so much happiness at such small cost. What goes on in these little birdies' brains, we may not find out; yet it would be just nice to know if gratitude were there, and maybe homage too; and if they looked to us as being unto them their Great, and Good, and Bountiful. Well, all this is the poor man's privilege, despite that greed of opulence:

> "Whose talons grasp the blessings of the world."

Our eastern snow-bird does not hold together long in large flocks, but does like to keep together in small bevies, or family groups. Whatever it is, whether conjugal, parental or filial, or all combined—there certainly is affection:

> "Oh, love is sweet through all the busy day time;
> Oh, love is true in winter and in May-time!"

The group I am interviewing numbers seven individuals; whether they are blood-kin I cannot affirm, but I adopt the hypothesis and feed them as a necessitous family. But see! Is a good deed contagious? These tiny things have caught the knack of charity among themselves! There is a poor little snow-bird on a rail; something ails it, for a stalwart Junco is carrying food and feeding it with nursely tenderness. To and fro goes the noble little fellow, until the hunger of its nursling is appeased. The bird is in some way lame of wing; and its benefactor knows all about it. But this in a little birdie's noddle, is a good deal; for a double question is under consideration, namely, hunger and safety, demanding foresight and strategy. If it would, the crippled bird could go to the window sill and help itself; for it has managed to keep up with the family flock, but with painful effort. These two words lighten up the whole case. Even the stalwarts come to the place of feeding not without circumspection and some distrust, being very watchful for grimalkin and every other danger; hence this thoughtful commiseration—that crippled bird must be allowed a position "surveying vantage." We have it from the professional bird trapper, that "snow-birds are not easy to catch."

Our *Junco hyemalis* has some really good qualities; he is social, and can be generous on occasion, and if clannish he is at least peaceably minded in his own family circle; with encouragement, I think the trick of familiarity would grow upon him, and he might become a welcome window bird in winter, like the English redbreast, sitting on the sill and pecking at the pane.

Although farther on I may have, for the sake of truth, to mention an instance, far from commendable, of Junco's ill conduct in the company of his "betters." As a cage bird he is cheerful, and generally bears a good reputation; he is reported to us, however, as impatient of restraint when the warm season comes; and I think that I have seen his best qualities in his winter freedom. He is winsome, and has a trace of humor—an unconscious serenity of the Mark Tapley order—for let the clime be almost Arctic, so but the rations hold out, he is gay and wide-awake; his plumage, too, is that of a well conditioned bird—so trim and smooth and bright. But here comes one of those proletarian summer bickerers—he of the bad reputation—"who killed Cock Robin." Poor sparrow! I do feel for him, with his fluffy outspread like a little impish owl, which "for all his feathers is acold." He moves squattingly, so as to hug his frozen toes. The snow-birds let him to their store and welcome; having fed well, they feel too good to be malevolent, and are enjoying a sort of pop-game, hopping in and out of their snow dug-out. But whom have we here? The Carolina wax-wing, close cousin to that big Bohemian; he is the only one of his tribe that has been along this winter; despite a trace of the stuck-up, there is something almost ducal in his coronal uprightness; nor is he at all crestfallen at the unwonted inclemency; in fact he is rather majestical in a toploftical way, and deigns, through a two minutes' patronage, to look at the snow-birds' frolic, and then leaves. A very practical fellow now appears in the apple tree near my window, the hairy woodpecker, and he begins business at once, pegging in for dear life after that larval Saperda. How he makes the chips fly, and breaks the cold stillness with his rat-ta tat-tat. All these are living episodes. But that poor moribund sparrow, he is so forlorn; and well he may be, for my boy reports that several of his fellows have just succumbed to the pitiless cold, and are lying stark-stiff in the barnyard. The truth told, the winter is exceptionally severe; reports from over thirty observers in our county declare that two-thirds of the quails have perished, albeit the efforts to feed them; and our village taxidermist has set up a number of "new birds," brought him by farmers who found them dead, and who say that many small birds have died of starvation. Well, what about Junco? O, he's become jocose; at least he seems to twitter: "This is none of my funeral." But then our Junco can be jolly under trying circumstances, and we must not write him down as going to the bad, simply because he trends a little on the heartless ways of men.

As hinted above, I think the snow-bird has capacities for human attachments. I saw one at a friend's house which had domiciled for the winter among the plants that filled the bay window. Over these hung a canary cage, the seed spilling from which fell into the flower pots, and were ample for Junco's wants. The bird seemed entirely at home, often leaving the window garden for the wider range of the sitting room. With the first snow of the winter, the bird had entered at an open door of its own accord; and when the spring came it took its departure in the same way.

I find myself so much interested by an account of a caged snow-bird, in a letter from my friend, Dr. Richard E. Kunzé, of New York, that I cannot refrain from giving an extract: "In my aviary I have kept from eighteen to twenty denizens, during the past winter. I had no canary, and only one snow-bird, *Junco hyemalis*, which I obtained from a bird dealer early in the winter. I kept him two months, and I think I had him just two months too long! They are regularly trapped and offered for sale in this city, on account of their frolicsome ways, and not because they are songsters. In song they are much inferior to our purple finch, song sparrow or yellow-bird, yet their song is more varied than that of the lesser red-poll. They also sing at night, and quite frequently when domesticated. His note at night is more of a monotonous character, amounting to just a whirring r-r-r-r-r-r—r-r-r-r-r-r—r-r-r-r, and so on, reminding one of a tree-toad more than anything else. Not being very timid, he naturally becomes very tame. He is rather too much of a pugnacious character for a well kept aviary, and to my sorrow I must confess that when last week I took him to one of the Central Park menagerie aviaries, it was with no great reluctance that I parted with him. Before his banishment he had destroyed the plumage of many a fine bird for me. In putting a new bird in my aviary, it is the aviarian custom to give him a hazing, like any other freshman of a higher order of beings; yet that snow-bird was not molested by any one, which, no doubt, made him bolder. I have in my aviary an African weaver-bird and a Japanese robin, both of which are not to be trifled with, and generally are very aggressive themselves; yet he chased them in pairs, as he did also the indigo bunting, yellow-bird, nonpareil and the smaller birds of the finch tribe.

"He ate every kind of food that he saw the others eat. When satiated he would get into a seed cup and throw out the larger seed, such as unhulled rice. He would then flirt with his feet like a chicken, and in a few minutes empty a cup of seed. After a while I placed a small flat wooden plant label across the cup, held in place by the wire of the cage to prevent him throwing out seed. He would hop along the top of it with the greatest delight, producing well measured sounds, by one end of the label being raised and then suddenly brought down with a sharp clap. While thus performing for minutes at a time, he often uttered low notes, and seemed to keep perfect time with his feet."

So it turned out that the little snow-bird was the coquinet, the clever little rascal of the establishment. I think his ability was exceptional. Perhaps he was a genius in his way; and being too roguishly cute for the general comfort, he must needs go into exile for the good of the community.

Dr. Kunzé informs me that quite a trade is carried on in New York exporting the snow-bird, *Junco hyemalis*, to Europe, and what seems strange is the fact, that the snow-bunting, *Plectrophanes nivalis*, is imported by us from Europe. But I must again quote my friend's letters; he says that "Reiche Brothers, of New York, sometimes take a lot of snow-birds to Europe, more for experiment than to fill orders. A smaller dealer is Mr. Schlawe, who is also trapper and fowler, and who watches the habits of our birds that are in demand very closely. He says that of all birds the snow-bird is certainly difficult to catch, notwithstanding the presence of great numbers in the field. No kind of food, or call-note will enchant this bird, or bring him with any kind of calculation under the fowler's devices. He claims that most of the snow-birds caught are accidental catches, and that it happens when fowlers set limed rods for *other birds!* Out of a hundred birds thus caught, only a very few are snow-birds, and oftener none at all. They will not enter a trap cage. He says that the bird is in fair demand, and that he could sell more than he caught. He says he has kept him through the summer very well, and that he is certainly a most hardy cage-bird. He often takes many to Europe on a single trip, and never lost a single specimen *in transitu*. He often takes these transatlantic journeys. On one of them he had forty snow-birds in one cage, and landed all safely in Germany, finding a market for them in Berlin without any difficulty."

However interesting to the philosopher a new species may be, it is "caviare to the general." If you would please the million show up your "white black-bird." Last summer it was given out that a white robin was in town, and forthwith every avicide from sixteen to forty-five years old, with gun in hand, inspected every shade tree in the village. The bird-killers were foiled. The robin had been and gone. And it was similar with the few who got the word of another arrival one bitter day in this cold February. Just before the gas was lighted "a snow-white snow-bird" had flown into the ticket office of our village depot. It was an albino. The poor bewildered thing sailed round the room close to the ceiling, much as a swallow would do; and what with the glare of the lights, and the heat, and the senseless efforts made to capture it by throwing hats, it had a really hard time. The door being opened, it darted out, and happily escaped; more fortunate than the one seen by Mr. Alcott in Connecticut in 1870.

Has there not been within the memory of man, a marked change in the migration habits of *Junco hyemalis?* They have their stragglers and "tender-foots," who do not go so far north to breed as do the others. Still the laggers seem capable of a topical compromise, nesting higher in the Southern mountains, while their tardier kindred, who venture farther north, nest lower down on the mountain sides. Was there not a time when this nesting southward of our eastern snow-bird was, at most, very exceptional? I see these birds so happy and in such good heart in the severest winter day, that I infer an Arctic constitution in the well-to-do's of the tribe. Were they not once like the snow-bunting, *Plectrophanes nivalis*, which nests as high as Labrador, but which, it seems, has twice been found nesting in the Northern United States. May one who is not even the son of a prophet venture a prediction for the bird men of the future, that the snow-bunting will be found working southward after the example of its cousin the snow-bird.

I do not remember the name of the bard, and fear lest I should garble his classic lines, yet the very best I can do is to quote his verse in an *ad sensum* way;

> "Noah of old, three children had,
> Or sons, I should say, rather;
> Shem, Ham and Japhet, called by dad—
> Now, who was Japhet's father?

The above it appeared was too much for Hodge; he could scratch his ear, but could not answer. Perhaps science has its

Hodges too. At any rate, who will riddle us this concerning the pedigree of our *Junco hyemalis?*

Junco a first ancestor had,
Or great original, rather;
If you'll point out, you'll make us glad,
Our Junco's great-grand-father.

Authors give several species of Junco, as follows, the first three being by some considered as mere varieties: *J. hyemalis*, our eastern snow-bird, *J. aikeni*, the white-winged, and *J. oregonus*, the Oregon snow-bird; besides these are *J. caniceps*, the chestnut-backed, and *J. annectens*, the chestnut-sided snow-bird. This much we must credit to Mr. J. Martin Trippe, as cited though hardly accepted by Dr. Coues. Are these all good species? I cannot go into the controversy, but will ask permission to adduce the following:

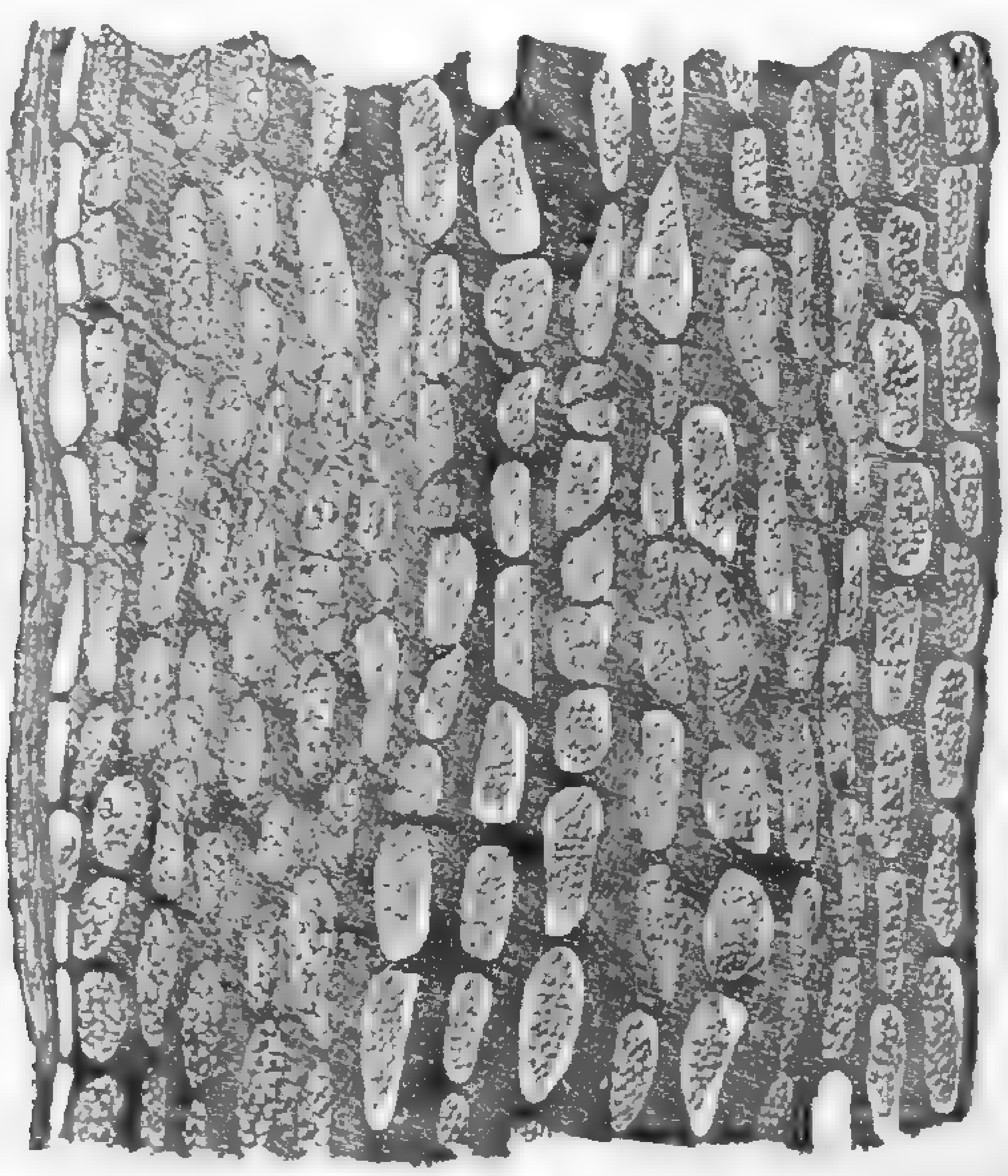
Once upon a time a patronymic dispute arose. With a geographical range so extraordinary as to preclude the idea of dispersion from a common center, there were the Smiths, and the Smithes, and the Smyths, and the Smythes, and the Schmits, and the Smids, and the Smeds. That there were differences also besides the names, was noticeable, such as black eyes, and blue eyes, and gray eyes, and hazel eyes. Still it was observable that what of difference there was, was best appreciated by themselves. But had these slight differences been overlooked, and the real similarities not been neglected; and in other ways, had the modern scientific methods been then in vogue, it might have appeared that in all this diversity there was not anything that had passed the varietal stage; that a nascent species had not been attained; in fact, with respect to the names, it had been suspected that really they were but one and the same cognominal. But an event happened which set all to take the matter in hand seriously; it came out that long ago a great ancestor had died and left "untold wealth" which was waiting the proper claimants. Discussion now brought out the fact that these patronymics were but evolutional variations of the same family name, which had been brought about by modifications of descent, the simple effect of time and circumstance, or in more modern phrase, the environment; for all had descended from one great ancestral stirp—the old, original, genuine *Johannes Smithius*, vulg. John Smith.

Perhaps we may yet decide as satisfactorily the stirp of the Juncos; meanwhile we lean to the belief that a *Junco hyemalis* was the grand ancestor of the whole tribe.

BACTERIA AS A CAUSE OF DISEASE IN PLANTS.

BY PROFESSOR T. J. BURRILL.

CERTAIN diseases of animals are now positively known to be due to the action of the minute organisms commonly known as *bacteria*. They are spoken of as "disease germs" or "spores," and the "germ theory" of disease is very fully discussed in medical literature. Among the best proved examples that the so-called germs are the actual *cause* of disease, we may cite anthrax in cattle, malignant pustule in man, and the diseases of swine and fowl ordinarily known as cholera. Many other contagious diseases of man and the domestic animals are scarcely less clearly known to be due to bacteria, but it has not been shown that they also cause disease and death of plants, except as recently announced by the writer in case of "blight" in pear and apple trees (August, 1880, American Association for the Advance-

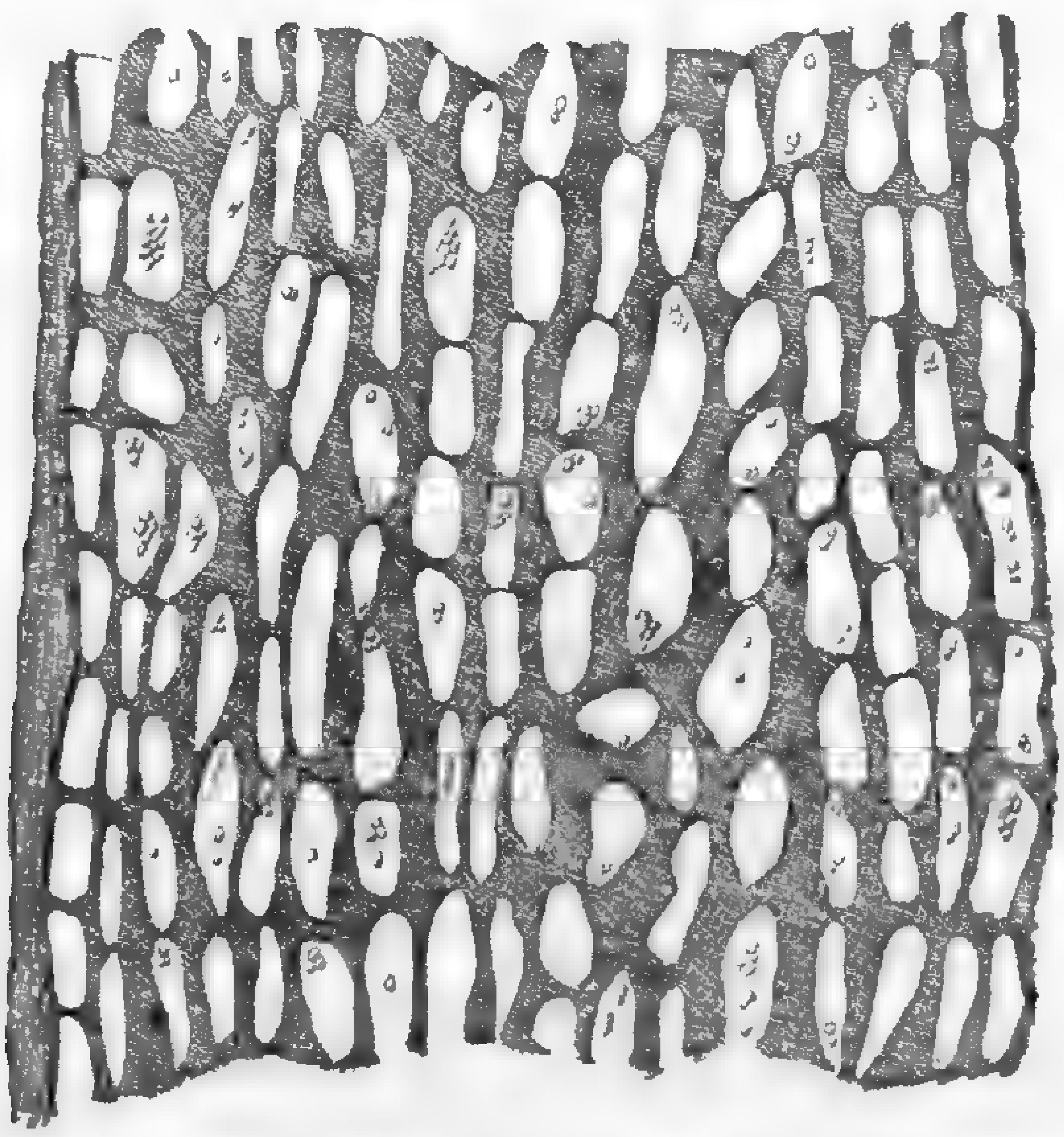


Healthy Pear Bark, showing cells filled with starch. Magnified 125 times.

ment of Science). I am now able to add the "yellows" of the peach with much confidence, without, however, the full investigation given to the former disease.

In 1877 I observed in the fluids of blighting pear trees, great numbers of minute, moving things which were not clearly identified as bacteria until the following year. Their presence was uniformly detected in every examination made (and they were numerous) during the summer of 1878, and the fact was reported to the Illinois State Horticultural Society, in December of that year (Transactions, p. 79). Investigations were not further prosecuted until June, 1880, when the unusual prevalence of the disease called more special attention to it. The same organisms, or those very similar, were as uniformly found in the tissues of apple trees suffering with the disease called twig blight. On diseased parts of both trees, drops of whitish, viscid material were often found, oozing from the bark, and this proved to be almost wholly made up of the bacteria. After some hours' exposure the mass became yellowish, and finally dark-brown. These bacteria are generally double jointed, each article being about .001 mm. (.0000393 in.) in transverse diameter, and about .0015 mm. long. Sometimes, however, the oval single forms are common, and not unfrequently longer ones of several joints are found.

Upon examining the infected tissues, the absence of the starch



Diseased Pear Bark, from limb three weeks afer blight commenced. Magnified 125 times.

granules, so abundant in the healthy cells, was especially marked. Tests revealed the fermentation of this starch with the evolution of carbon dioxide, hydrogen and butyric acid. The other carbonaceous materials in the cells, as sugar, malic acid, &c., doubtless undergoes the same fermentation, but being soluble in water their loss is not rendered evident by the microscope. The cell walls contrary to my expectation, were not found injured, neither was the protoplasm involved in the fermentation.

By passing a thin section of the bark under the microscope, it is possible to find in the same slice, all variations, from perfectly healthy cells to those which have lost the whole of the stored starch, the bacteria likewise varying in numbers as the destruction of the starch bacteria progresses. How these originally gain entrance to the cells was not made out. There are certainly no pores or other visible openings through which they pass. Water, however, is absorbed by the cell walls, and passes through their molecular spaces in all directions. It may be that in the germ condition the bacteria are really small enough to pass with the water through the walls, notwithstanding the fact the highest powers of our microscopes fail to detect the molecular openings. However this may be, it is positive enough that the adult bacteria do not in this way traverse the cell walls. The evidence is totally against any distribution of the organisms in the tissues by the circulations of water or sap. They slowly make their own way from cell to cell, progressing equally in all directions from the starting point when the same conditions are presented.

On July 1, 1880, I inoculated two pear trees by inserting small pieces of bark from a pear tree in which the disease was in active progress. On the 12th and thereafter, inoculations were made by dipping a clean needle or the sharp point of the blade of a penknife into the viscid substance exuding from diseased bark, diluted or not with distilled water, and thrusting the instrument into the experimental trees. Usually three such punctures were made near each other, but the three were counted as one inoculation.

No visible results followed any of these inoculations during the first eight days, and in some cases for two or even three times this period. In the majority of cases ten to twelve days elapsed before external signs of the disease could be observed. No difference was detected in this or any other respect in the different ways of inoculation. But numerous external applications of the virus were made to the bark and leaves without wounding, none of which seemed to communicate the disease. The trees were examined at least once each day until the 14th of August, 1880, and every observed change carefully noted. Very often the disease could be detected by dissections and microscopical examinations when no external indications were presented, but these were not counted as successful inoculations except in very clear cases.

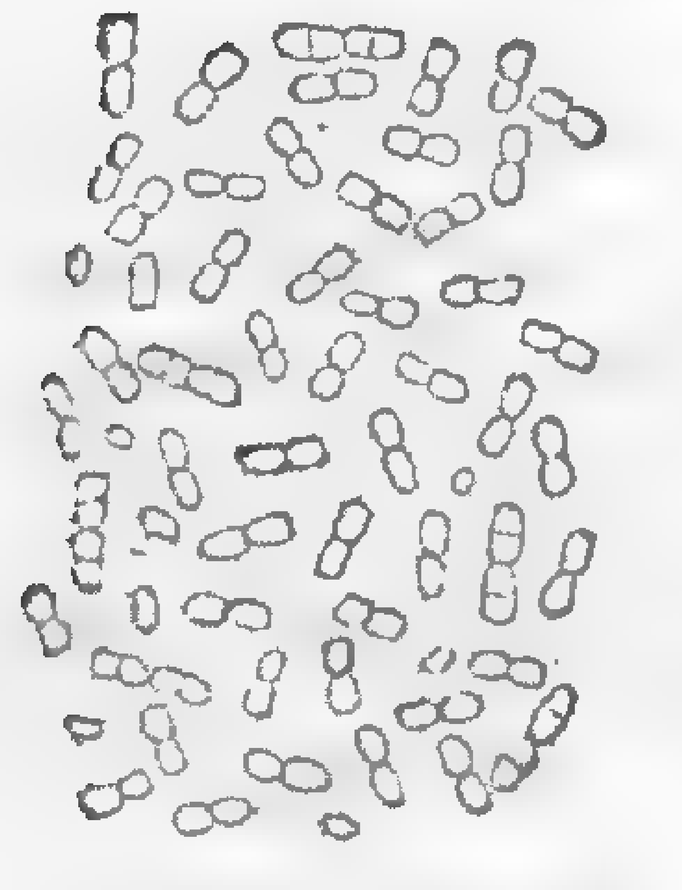
The experiments upon pear trees were made upon trees three years old, Bartlett and Clapp's Favorite, seventy-two in number. The apple trees are Grime's Golden, and the quince, Angers.

The following table gives the results in per cents of the number of successful inoculations:

Number of Experiments.	Kinds of Trees.	Virus from Pear.	Virus from Apple.
36	Pear	54	72
29	Apple	30	Not tried.
4	Quince	100	Not tried.

It will be observed that the virus from the diseased apple limbs was more fatal to the pear than that from blighting pear, showing at least that the disease in the apple is of the same nature as that known as fire blight in the pear. It is quite possible, however, that the greater percentage is due to other causes than the virulence of the inoculating material, and that another set of experiments would show this. The low per centage in case of the apple (30) inoculated with pear virus is partially explained from the fact that ten inoculations were in the bark of portions more than one year old, none of which were successful. As these trees show blight for the most part in the shoots of the current year's growth only, some reason for the failure may be conceived. But four inoculations were made in the quince, all of which communicated the disease. These were made upon the young shoots of a bushy tree which was not otherwise unhealthy.

Since these experiments were made, careful study has convinced me that the death of patches of bark on the trunk and larger limbs of the apple tree is due to the same cause. The disease slowly progresses from the center of infection and kills the tree when the whole circumference becomes involved. Sometimes, however, the liber (the bast cells are not penetrated by the bacteria) forms a complete shield to the inner tissues, and after the outer cellular bark is destroyed a new layer is formed beneath, the old finally falling away.



Blight Bacteria. Magnified 1000 times.

Meteorological conditions probably have some influence, but how much and what is not clear. The disease slowly progresses in winter as well as summer, in dry weather as well as wet. The sudden appearance often noted is but the blackening of the leaves upon a branch long diseased.

The slow progress of the malady gives the best hope for successful treatment. It has been considered sudden and irregular, with little or no indications of trouble until destruction came; but this is greatly over-stated. Acquaintance with the first appearance in the bark, and careful examination every two or three weeks, will make treatment much more possible than heretofore supposed. The remedy proposed is the old one of cutting away the diseased portions, adding, however, the precaution of taking all infected parts, and not merely such as have become blackish after the ravages are complete, and to observe requisite care in cleansing the knife or other instrument, that by the very process of cure the contamination is not spread. Probably carbolic acid or other antiseptic washes may be useful, but proof from actual and indisputable experiment has not yet been reached.

Very recent examinations of material sent from Michigan conclusively confirms my opinion that the yellows of the peach tree is caused by a similar organism. In the cells of an infected shoot I find very little stored starch, but numerous bacteria. These are seemingly different, under a one-tenth Tolles' or Spencer's objective, from the bacteria of the pear and apple. Compared with the latter, they are long and slender, measuring about .001 mm. by .0035 mm. They consist of several joints, but little longer than wide in what appears to be the typical forms.

The Lombardy poplar trees are also destroyed by these ferment producing agents, following the attacks of certain wood-boring coleopterous larvæ. The latter penetrate the bark and take devious courses through the bark parenchyma and the cambium layer. Starting from their channels, the bacteria slowly spread from cell to cell, until so much of the essential tissue is destroyed that the tree, after some years of hopeless struggle, succumbs. Sometimes the bacteria collect in immense numbers in pockets, which they appear to form in the bark of this tree by absorption of the cell walls. The thick, white mass which they thus form, has the appearance to the unaided eye of pus from sores in the flesh of animals.

The aspen *(Populus tremuloides)* is similarly affected. The young limbs die and the leaves become black in a manner every way similar to those of the pear and the apple.

RECORD OF AMERICAN CARCINOLOGY FOR 1880.

BY J. S. KINGSLEY.

IN continuing the record of American crustacean literature, begun by the writer last year (NATURALIST, XIV, pp. 498–503), the principal papers will be considered under the heads, systematic, anatomical and embryological, and in these by authors in alphabetical order. A complete list of papers, so far as known to the recorder, completes the record.

Descriptive papers have this year been few and are of apparently a better character than is frequently the case, a goodly proportion being monographic in character. Messrs. Harger, Kingsley, Packard and Smith are the only writers who have described new species during the year. Mr. Harger (4) presents a valuable synopsis of all the marine Isopoda of the New England coast, with full synonyma and good illustrative figures. He begins with a general account of the external anatomy of the Isopoda; next comes the systematic portion, by which we find that New England possesses 46 species arranged under 34 genera and 14 families. One new genus and species is described, *Syscenus infelix*, and of this but a single specimen is known. Possibly its solitary condition and consequent lonesomeness prompted the specific name. Following the systematic portion we find a résumé of the geographical and bathymetrical distribution, from which we learn that 11 species are found only south of Cape Cod, 19 exist only north of that barrier, while 16 are common to both sides of the cape, and 11 species are common to both Europe and America. A very complete bibliography concludes the article, enumerating over two hundred titles. We notice, however, that the excellent articles of Schiodte and Meinert[1] are nowhere mentioned. With our marine Isopods in this excellent condition, we wish that Mr. Harger or some other equally competent naturalist would undertake to straighten out the terrestrial forms, on which, with the exception of work by Say, Fitch, Dana and Stuxberg, but little has been done.

Mr. Kingsley has been the largest contributor to systematic carcinology, but this is hardly the place for a critical review of his work. His first paper (7), though issued in the Proceedings of the Philadelphia Academy for 1879, was not printed until the

[1] See NATURALIST, XIV, p. 519, 1880.

beginning of 1880, and hence falls within the scope of this record. It gives an account of the Crustacea collected by Professor H. E. Webster of Union College, in Virginia, North Carolina and Florida, together with a revision of the genera of shrimps. This paper has been noticed by Professor Smith (29). It may be well to say that the genus *Xiphocaris*, which in the article is merged with *Caulurus*, really is distinct, and belongs to the Atyidæ, near *Caradina*, as an examination of the mandibles has shown.

The four remaining papers to be noticed treat of the grapsoid Crustacea. The first (14) is on the Thelphusidæ, describing some new forms and giving notes on the habitats of others. The next (15) is a revision of the fiddler crabs of the world, in which the known species are reduced to forty-one. A further examination of types ard more complete series would probably reduce the number still further. Two new species are described. The Ocypodæ are next treated in the same manner (16), 11 species (1 new) being recognized. The last of the series (17) takes up the family Grapsidæ, giving descriptions and analytical keys to the majority of the forms. The nominal species of *Sesarma* are merely enumerated in alphabetical order, the task of simplifying and straightening them out being too much for the writer. Several genera and many species are thrown into synonymy, and the geographical distribution of many is greatly extended. Two new genera and species are characterized, and, including the Sesarmæ, 159 species are enumerated.

Professor Packard, who has in progress a monograph of the North American Phyllopoda, describes (19) *Streptocephalus floridanus* as new, and gives notes on other Phyllopods.

Professor Smith, our oldest publishing American carcinologist, contributes several short articles which, like all of his papers, add greatly to our knowledge of the Crustacea. In the first of these articles to be noticed (26), the presence of the destructive *Chelura terebrans*, a wood-eating Crustacean, is recorded on our shores. In the next (31) some forms of British Columbia are discussed. A single new genus and species of Cumacea, *Diastylopsis dawsoni* is described, and the notes on the other forms enumerated throw much light on our knowledge of the west coast species. In his paper on *Pinnixa* (32), to be referred to again, the New England species, two in number, are described. The next paper

(33) discusses the presence of certain tropical and subtropical forms on the New England coast. These are ten in number.

Concerning some of the Crustacea described by Thomas Say, there has been considerable uncertainty, and in the case of three genera of Amphipods, Mr. Smith (34) presents us extended descriptions of Say's forms, and settles the disputed points. The genus *Erichthonius* is considered as belonging to a distinct subfamily from *Cerapus*, with which it has been confounded.

Dr. Packard is the only one who has published anything concerning the anatomy of the Crustacea, and his articles have all been upon the eye and brain of Limulus, and are all published in the pages of the NATURALIST, and hence do not need more extended notice here. A more extended paper on Limulus,[1] though bearing date 1880, did not appear until the beginning of the present year, and will be noticed more at length elsewhere.

Dr. Brooks has published preliminary accounts of the embryology of the curious genus *Lucifer* (1 and 2). We understand that the complete history will appear in the Philosophical Transactions of the Royal Society. The most important feature discovered is that the young *Lucifer* is a Nauplius and not a Zoëa as is the case with most Decapods. This discovery adds additional probability to the statement of Fritz Müller that the young of *Peneus* is also a Nauplius.

Mr. Emerton (4) figures the nauplius of a barnacle.

Dr. Faxon (5) discusses the membrane which envelops the larva of *Carcinus mœnas* and the morphology of the zoëal antennæ; seven figures are given of the zoëa of *Panopeus sayi*, and one of the tail of zoëa of *Gelasimus pugnax*. The text is so condensed as not to admit of putting into an abstract, and students are referred to the article itself. The two folded plates accompanying the paper are very good.

Professor Smith's paper on *Pinnixa* (32) should be read in connection with that of Dr. Faxon, noticed in the review of last year.

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[States that in Lucifer, as in examples from other classes of animals, there are periods of activity and rest in the segmentation of the egg. This had previously been commented upon by several embryologists.]

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[Gives figures, original and copied, of several forms.]

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HARGER, OSCAR—

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[An abstract of Grobben's paper on the same subject.]

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ABORIGINAL STONE-DRILLING.

BY CHARLES RAU.

ABOUT twelve years ago, I published an account of my experiments in drilling in stone without the aid of metallic tools,[1] and, though during the interval my attention was constantly fixed upon archæological matters, I had, on the whole, no occasion for changing the opinions then expressed.

In the meantime, however, similar experiments, made by European archæologists, were commented on by Mr. John Evans, who, after a due consideration of the subject of stone-drilling, gives the following summary of methods:

"On the whole, we may conclude that the holes were bored in various manners, of which the principal were—

1. By chiseling, or picking with a sharp stone.
2. By grinding with a solid grinder, probably of wood.

[1] Drilling in Stone without Metal; Smithsonian Report for 1868, p. 392–400.

3. By grinding with a tubular grinder, probably of ox-horn.
4. By drilling with a stone drill.
5. By drilling with a metallic drill.

"Holes produced by any of these means could, of course, receive their final polish by grinding."[1]

It appears doubtful to me whether in North America (north of Mexico) metallic tools for drilling stone were used, considering that the only metal which could have been employed for such purposes was hammered native copper—a substance too soft to be applied to any kind of hard stone without the aid of a very efficient triturated grinding material. Nor do I believe that the former inhabitants had sufficient skill in working copper to fashion it into a tubular tool suitable for stone-drilling; and to my knowledge no such object has ever been discovered in the United States. Soft stone, moreover, could be bored with greater facility by means of properly-shaped flint implements, as will be exemplified in this article. Even bronze, I think, would be found less serviceable than flint for drilling stone of inferior hardness.[2]

Dr. Ferdinand Keller, of Zürich, the meritorious investigator of Swiss lake-habitations, has made quite interesting experiments in drilling stone and other substances employed by the lake-dwellers. He operated on stone with tubular bones of goats and sheep, and with hollow cylinders of stag-horn and yew-wood, these drills being inserted into spindles slightly pressed at the upper end, and set in motion by means of a bow. This apparatus corresponded in general principle to that figured by me on page 399 of the Smithsonian Report for 1868. Water and quartz sand, of course, were necessary agents in the operation. Dr. Keller expresses himself quite satisfied with his success; for there appeared the round, smooth hole, with the characteristic parallel striæ and the core at its bottom, which is always seen in unfinished antique specimens drilled with a hollow tool. The work, however, progressed very slowly, and the operator adds to this statement the observation that no prepared hollow bone, which might have served as a drill, has thus far been discovered in the lacustrine deposits of Switzerland. After these experiments it occurred to him to employ a hollow cylinder made of ox-horn,

[1] Evans: The Ancient Stone Implements, Weapons and Ornaments of Great Britain; London, 1872, p. 48.

[2] For carving on hard stone, such as granite, bronze tools have been found to be almost useless. A trial of this kind is described in my Smithsonian publication entitled "The Palènque Tablet in the United States National Museum," p. 37, note.

and he obtained now more favorable results, owing to the yielding substance of the horn, in which the sand became imbedded and acted like a file. "The objection," he says, "that no drills made of this material have been discovered, is rendered invalid by the nature of the horns of bovines, which are totally dissolved in water in a comparatively short time."[1]

Methods like those employed by Dr. Keller, may have been practiced by the aborigines of this country; yet among the hundreds of bone and horn implements which have passed through my hands during my connection with the United States National Museum, not one exhibited the character of a hollow drill, and I am not aware that any of the collections of this country contains such a tool. But I must not omit to state what I learned in 1875 from a Warm Spring Indian belonging to a delegation which had come to Washington for the purpose of transacting business with the Government. These Indians were well supplied with pipes, mostly made of alabaster, and shaped like the ordinary catlinite pipes. With some difficulty I obtained from one of them the information that they drill the cavities of their pipes with bone tools, and, in order to strengthen his assertion, he led me to a case in the Museum in which objects of bone were exhibited. The cavities of their pipes, some of which were purchased from them, appear to have been produced by solid rather than hollow drills. According to Catlin, the pipes made of the material now named after him, are (or were) drilled by means of a wooden stick, in conjunction with sand and water.

In my account of drilling, referred to in the beginning of this article, I should have stated with greater emphasis that, in illustrating the possibility of perforating very hard stone by employing a revolving stick and sand and water, I was far from underrating the efficiency of a flint tool for drilling stone of less obdurate character. In operating with a well-pointed flint arrow-head, firmly set in the cleft end of a short stick, on a fragment of a pierced tablet of tolerably hard slate, I produced in about half an hour a small perforation in no way distinguishable from one made by an aboriginal worker in stone. The perforations in these tablets are either conical or bi-conical. By drilling from both sides of the fragment I made one of bi-conical form; if I had continued

[1] Keller: Durchbohrung der Steinbeile, Hirschhornwerkzeuge und anderer Geräthe aus den Pfahlbauten, in: Anzeiger für Schweizerische Alterthumskunde; Zürich, Juni, 1870, S. 139–144.

to drill from one side only, the bore would have assumed a conical shape. I simply turned the improvised tool with the hand like a gimlet, exerting a moderate pressure, and wetting the cavity from time to time with water. During the operation very diminutive particles of the drilling tool came off with a slight crack, and the flint showed afterward scarcely any wear. This fact is worth noting, as it accounts for the fresh appearance of many flint tools which undoubtedly have served for drilling purposes.

Any one who has handled a large number of North American flint implements must be aware that there are some which approach in outline more or less the arrow-head shape, but exhibit a rounded edge instead of a point. They might often be taken for cutters; yet many of them, I am now inclined to believe, served as tools for boring stone of inferior hardness, the curved extremity forming, of course, the penetrating part of the drill. My view is based upon the fact that an implement of this kind actually has been found in the unfinished bore of an aboriginal stone object, now in possession of Mr. James Wood, of Mount Kisco, Westchester County, New York. Last year that gentleman, who is President of the Westchester County Historical Society, was kind enough to send the partly-drilled specimen, together with the drill, for examination to the Smithsonian Institution, where I caused drawings of both to be made. The objects were found at Croton Point, on the Hudson, in Westchester County, by Mr. Wood's cousin, a lad about thirteen years of age, whose veracity cannot be doubted, and who is not at all given to collecting aboriginal relics, of which, indeed, he has no knowledge. The genuineness of the discovery is beyond any suspicion.

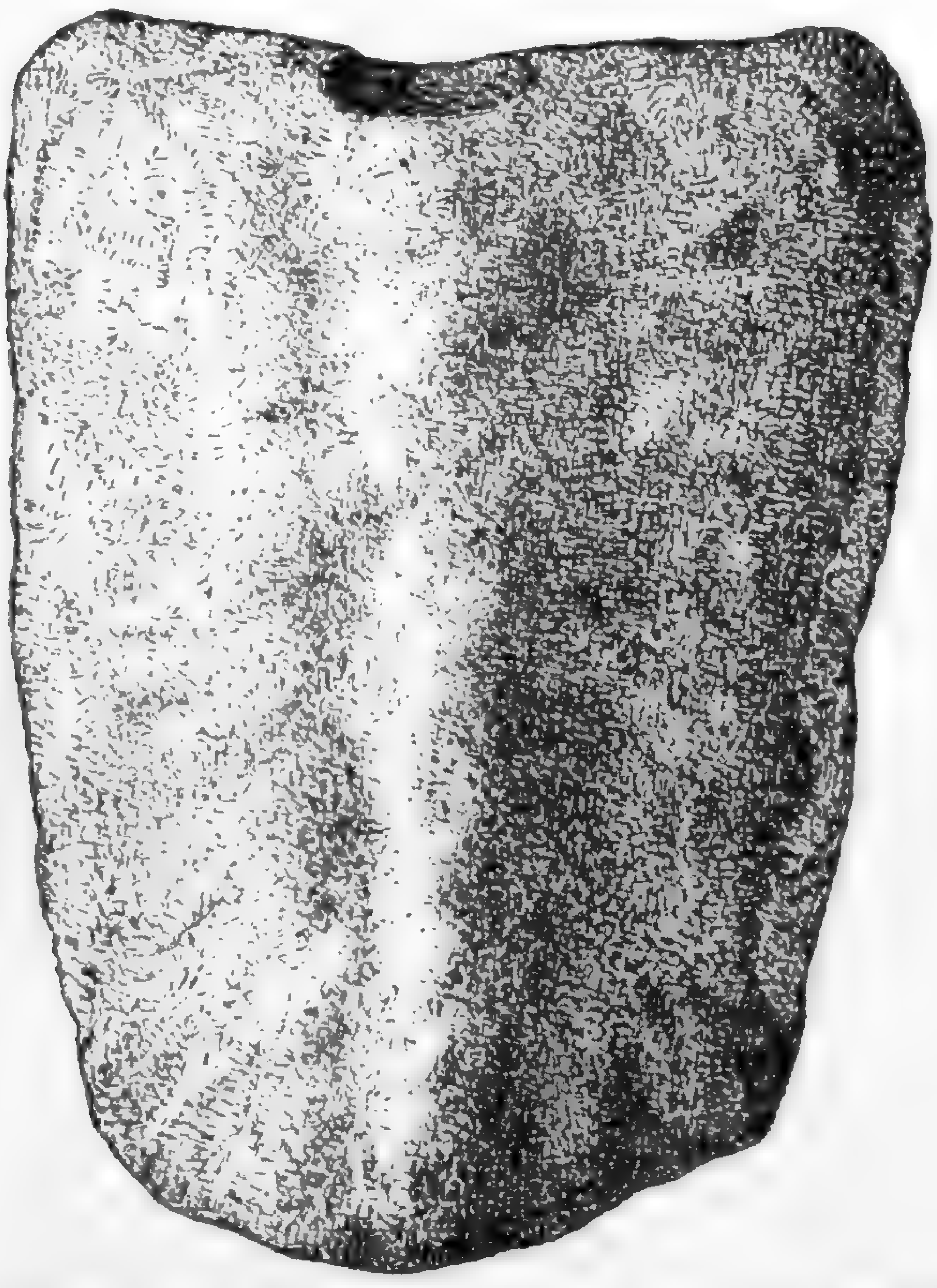
Figure 1 shows the character of the drilled object, which is a rather rude exemplification of a type not unfrequent in the United States, and represented by a number of specimens in the archæological collection of the National Museum, where I have classed them for the present with the drilled ceremonial weapons, sometimes very inappropriately called "banner-stones."[1]

The specimen in question consists of chloritic potstone, a very soft material, which could easily be fashioned and drilled. The

[1] A specimen not unlike the original of Figure 1, though larger and of a more regular shape, was found in the town of Monkton, Vermont. It is figured and described in "Proceedings of the American Association for the Advancement of Science" (Twenty-eighth meeting, August, 1879); Salem, 1880, p. 526, etc.

bore is an inch and a half deep and nine-sixteenths of an inch in diameter at the orifice. It is straight and smooth, but shows parallel furrows or striæ impressed by the corners and slight lateral projections of the drill. The latter, represented by Figure 2, consists of black hornstone and is very carefully chipped. It is an entirely uninjured specimen. When Mr. Wood's young relation found the potstone implement, its bore was filled with earth, the removal of which brought to light the flint drill. It stuck in the

1



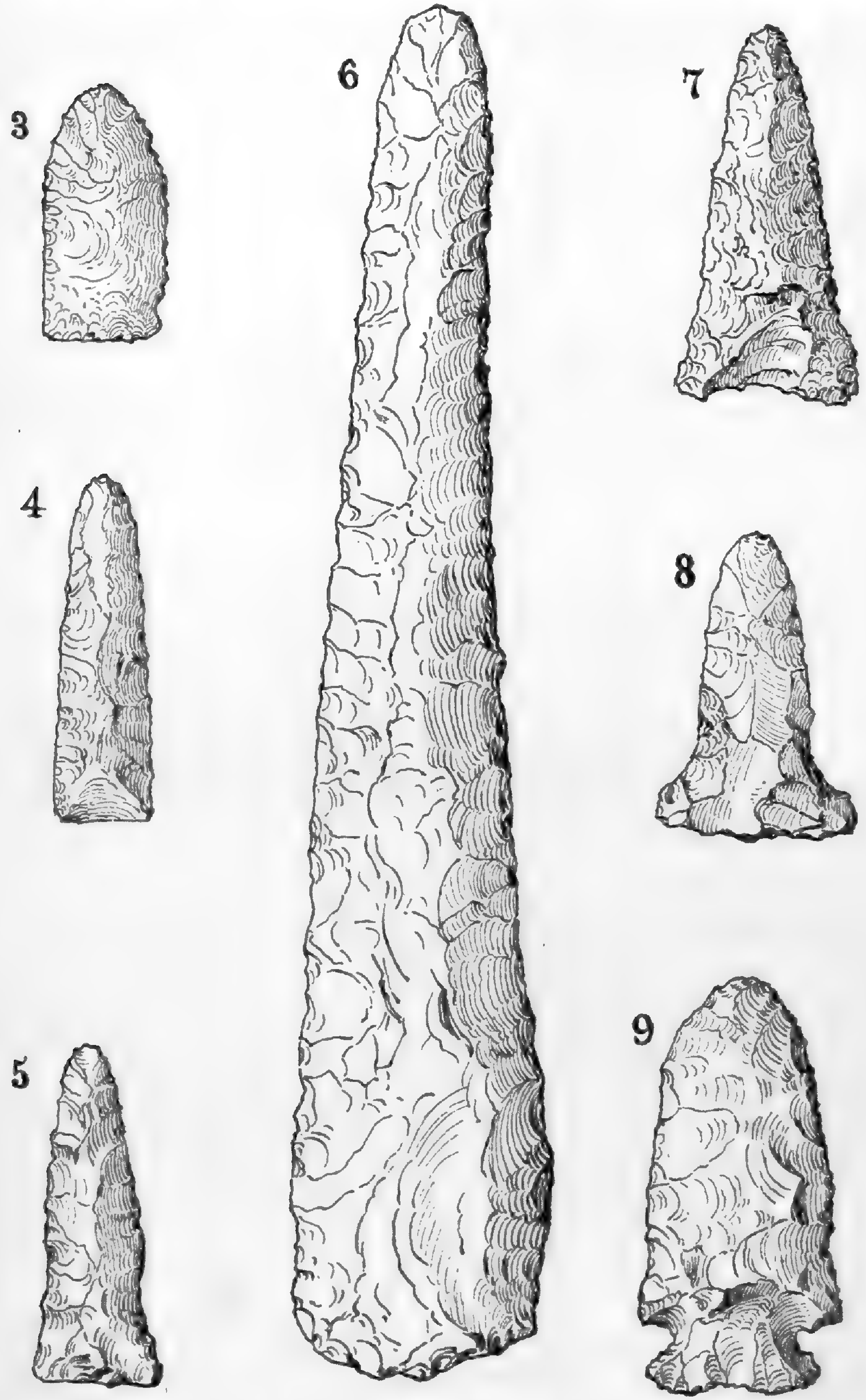
2

FIG. 1.—Stone object with unfinished bore, and (2) the drill used in the operation. Westchester County, New York (natural size).

lowest part of the bore, which exhibits here a shape corresponding exactly to the somewhat tapering form of the tool. No trace of a handle, without which the drilling could not have been performed, was found. Its material—doubtless wood—had totally disappeared.

It rarely happens that a discovery of such demonstrative character is made, and I therefore concluded to publish the present account, which, no doubt, will be of interest to the many who care for the details of North American archæology.

In Figures 3–9 I present delineations of some of the stone im-



FIGS. 3–9.—Stone drills in the U. S. National Museum (natural size).

plements in the National Museum, which resemble more or less

Mr. Wood's specimen, and to which I ascribe the character of drills.[1]

Figure 3.—Original made of light-brown stone of chalcedonic appearance. Colorado. (Museum No. 9208.)

Figure 4.—Yellowish flint. Ohio. (Museum No. 16,484.)

Figure 5.—Gray jasper. New York. (Mus. No. 6180.)

Figure 6.—Cast of a large implement of brownish hornstone. The original is in possession of Mr. L. Leppelman, of Fremont, Ohio. (Museum No. 35,624.)

Figure 7.—Yellowish-brown jasper. Connecticut. (Museum No. 6084.)

Figure 8.—Dark-gray hornstone. Ohio. (Museum No. 16,484.)

Figure 9.—Light-reddish jasper. West Virginia. (Museum No. 13,376.)

Having properly hafted the original of Figure 8, I operated with it on a piece of an aboriginal potstone vessel, three-fourths of an inch in thickness, which I perforated in about twelve minutes, the result being a bore not quite as regular as that exhibited in Mr. Wood's specimen, but otherwise resembling it in all essential points. The manipulation was the same as in the previously-described experiment by which I obtained a small bi-conical perforation.

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ON THE EFFECT OF IMPACTS AND STRAINS ON THE FEET OF MAMMALIA.[2]

BY E. D. COPE.

THE principal specializations in the structure of the feet of the Mammalia may be summarized as follows:

I. The reduction of the number of the toes to one in the *Perissodactyla* (horses, etc.), and two in the *Artiodactyla* (cloven feet).

II. The second hinge-joint in the tarsus of the *Artiodactyla.*

[1] The specimen from the Yorkshire Wolds, represented by Figure 231 on page 291 of Mr. Evans's work (Ancient Stone Implements, etc.) appears to belong to the same class of tools.

[2] Read before the National Academy of Sciences, April, 1881. Abstract. Some of the points of this paper have already been discussed in the NATURALIST (April), but the present abstract contains additional matter.

III. The trochlear ridges and keels at the various movable articulations of the limbs. These are as follows:

1. Looking downwards—
    - *α*. Intertrochlear crests of the humerus.
    - *β*. On the carpal end of the radius.
    - *γ*. Metacarpals, distal ends.
    - *δ*. Tibia distally.
    - *ε*. Metatarsals distally.
2. Looking upwards—
    - *α*. Radius distally.
    - *β*. Astragalus, edges.
    - *γ*. Astragalus distally (*Artiodactyla*).
    - *δ*. Phalanges (very weak).

The following observations may be made respecting the structures included under division III: The trochlear keels which look downwards are much the most prominent and important. Those enumerated as looking upwards are weak and insignificant, or of a different character from the down-looking ones. The latter are all projections from the middles of the ends of the respective elements. The up-looking are generally projections of the edges of bones. Such are the lateral crests of the astragalus,

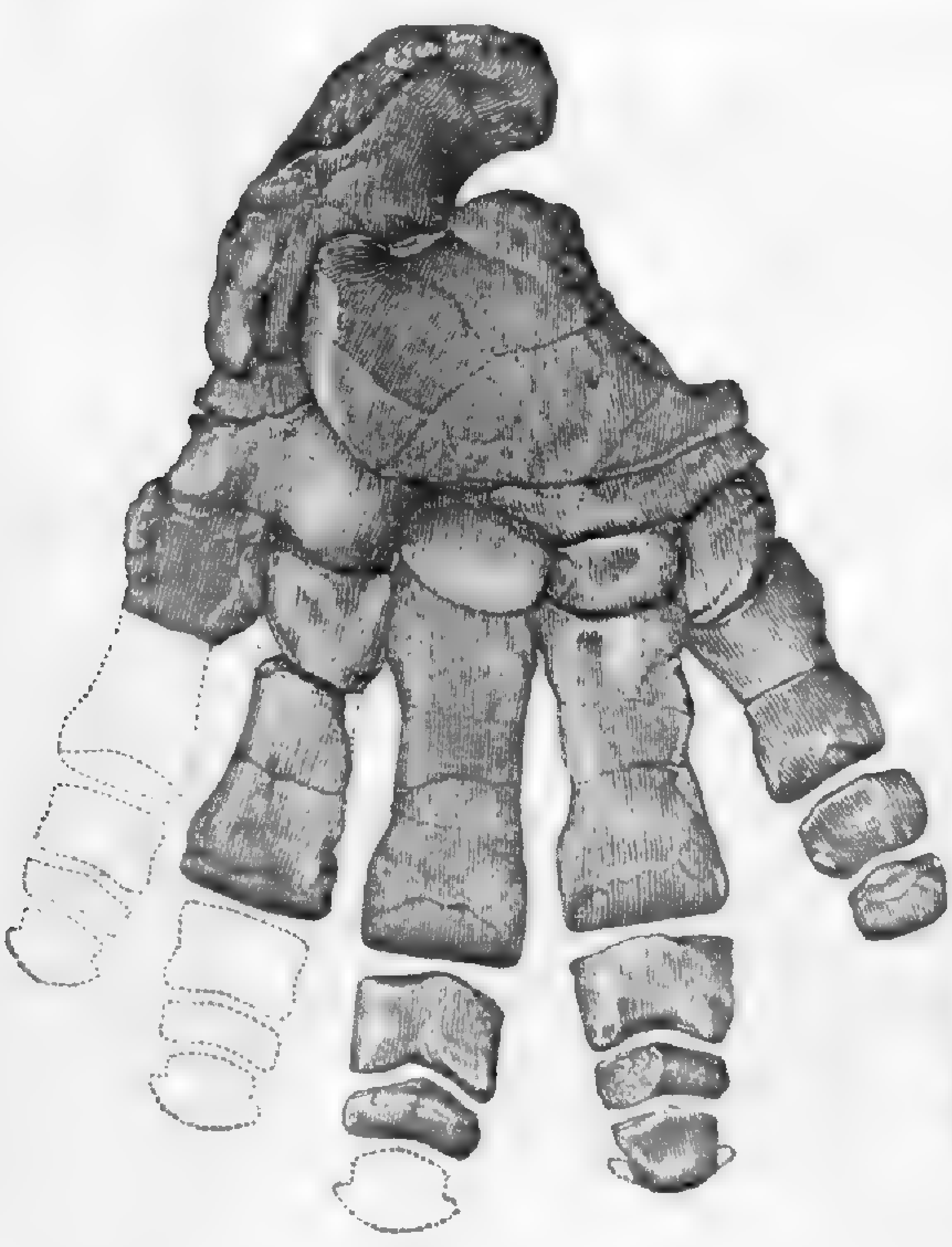

FIG. 1.

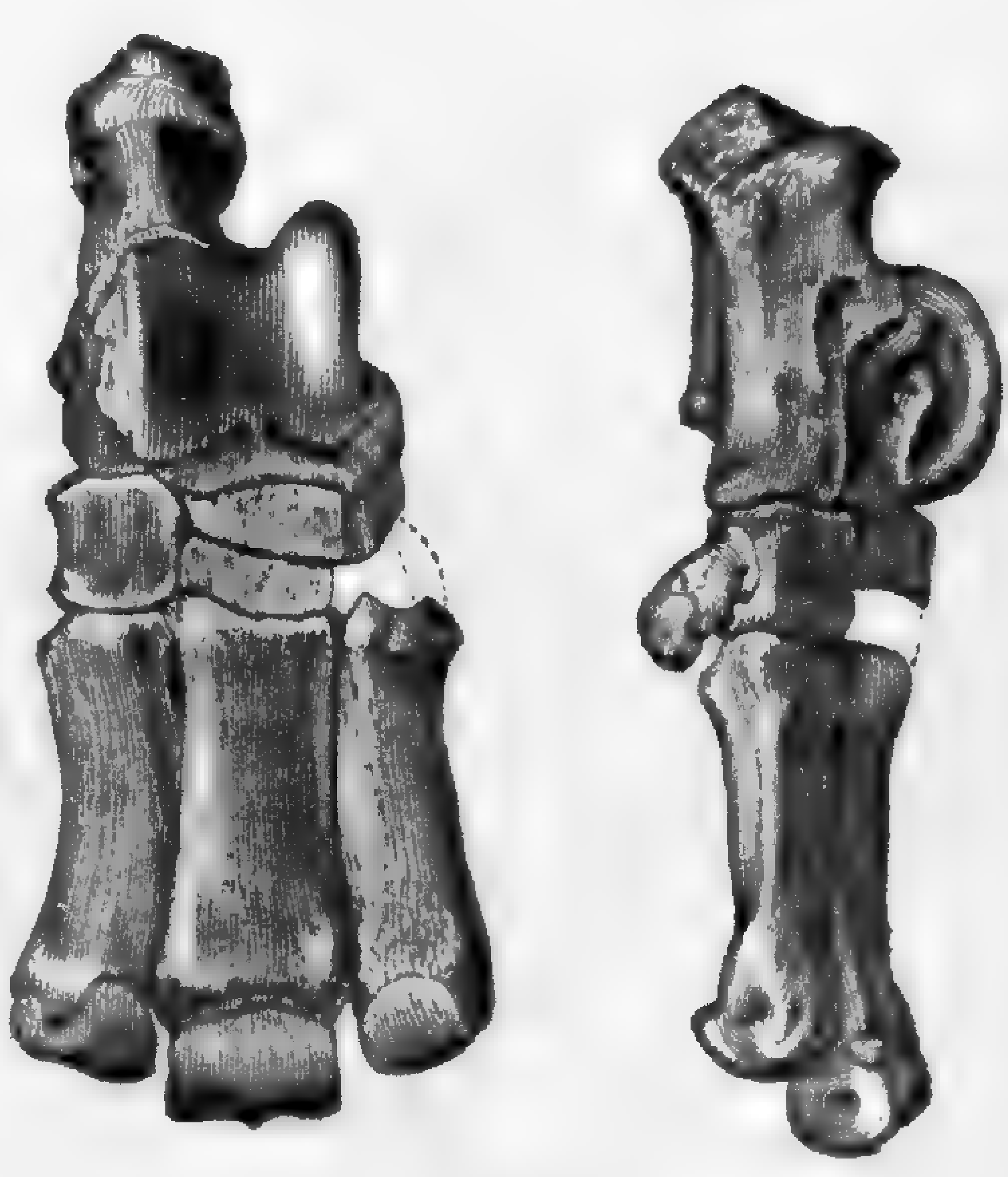

FIG. 2.

FIG. 1.—Right posterior foot of a species of *Coryphodon* from New Mexico, one-half nat. size. From Report Expl. W. of 100th Mer., G. M. Wheeler, IV, Pl. LIX.

FIG. 2.—Right posterior foot of *Aphelops megalodus* Cope, from Colorado, one-half natural size. From Report U. S. Geol. Surv. Terrs., F. V. Hayden, IV, Pl. CXXX.

and the adjacent edges of the cuboid and navicular bones which cause the distal emargination of the astragalus in the *Artiodactyla*. The proximal ridges of the phalanges are very weak, and the concavities in the extremity of the radius cannot be called trochlear, as they are adaptations to the carpal bones.

I. The reduction in the number of toes is supposed to be due to the elongation of those which slightly exceeded the others in length, in consequence of the greater number of strains and impacts received by them in rapid progression, and the complementary loss of material available for the growth of the smaller ones. This is rendered probable from the fact that the types with reduced digits are dwellers on dry land in both orders, and those that have more numerous digits are inhabitants of swamps and mud. In geological history it is supposed that the Perissodactyles

FIG. 3.

FIG. 4.

FIG. 3.—Right posterior foot of *Protohippus sejunctus* Cope from Colorado, about one-half natural size. From Report U. S. Geol. Surv. Terrs., F. V. Hayden, IV.

FIG. 4.—Right posterior foot of *Poëbrotherium labiatum* Cope, from Colorado, three-fifths nat. size. From Hayden's Report, IV, Pl. CXV.

(figures 2–3) originated from the *Amblypoda*, or primitive *Ungulata* (figure 1), which first assumed terrestrial habits, while the *Artiodactyla* (figures 4 and 9–11), originating from the same order, long continued as mud dwellers; as witness the hippopotami and hogs of to-day. The mechanical effect of walking in the mud is to spread the toes equally on opposite sides of the middle line. This would encourage the equal development of the digits on each side of the middle line, as in the cloven-footed types. In progression on hard ground, the longest toe (the third) will receive the greatest amount of shock from contact with the earth. There is every reason to believe that shocks, if not excessive, encourage growth in the direction of the force applied. This is strongly suggested by the relations between the length of the legs and the rate of speed of animals; and the lengths of the teeth and their long-continued use. Certain it is that the lengths of the bones of the feet of the Ungulate orders have a direct relation to the dryness of the ground they inhabit, and the possibility of speed which their habitat permits them, or necessarily imposes on them.

II. The hinge between the first and second series of tarsal bones in the *Artiodactyla*, may be accounted for by reference to the habits which are supposed to have caused the cloven-footed character. Observation on an animal of this order walking in mud, shows that there is a great strain anteroposteriorly transverse to the long axis of the foot, which would readily cause a gradual loosening of an articulation like that connecting the two series of tarsals in the extinct *Amblypoda*. Any one who has examined this part of *Coryphodon* will see that a little additional mobility at this point would soon resemble the second tarsal joint of the hogs. In the case of animals which progress on hard ground, no such cross-strain would be experienced, and the effect would be to consolidate by flattening the fixed articulation.

III. The trochleæ. These prominences, which form the tongues of the tongue and groove articulations, exhibit various degrees of development in the different *Mammalia*. Those of different parts of the skeleton coincide in their condition in any one type of ambulatory *Mammalia*, and so may be all considered together. This fact suggests strongly that they are all due to a common cause.

They are all imperfect in the *Rodentia* and *Carnivora* (figures 5–6) (except the *Leporidæ*, which are especially characterized by their great speed). Among ungulates they are very imperfect in the *Proboscidea*. The orders mentioned all have elastic pads on the under sides of their feet or toes. The same is true of the lowest types of both the *Artiodactyla* and *Perissodactyla*, the hippopotami and rhinoceroses. In the *Ruminantia* the trochleæ are well developed (figure 10) with one ex-




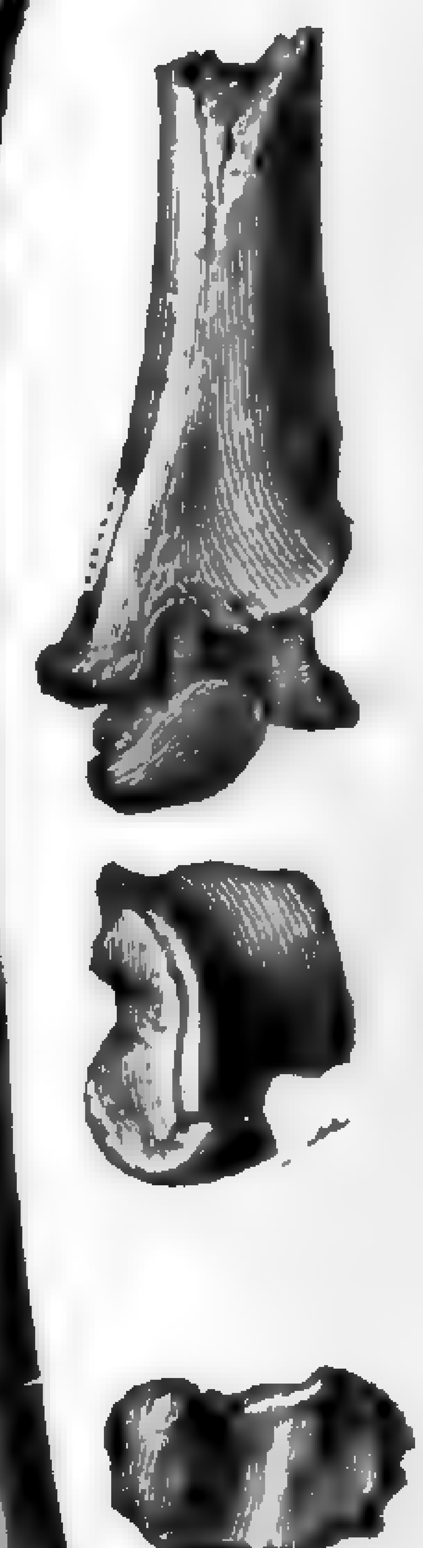

FIG. 5. FIG. 6. FIG. 8. FIG. 7.

FIG. 5.—Distal extremity of tibia of *Amblyctonus sinosus* Cope. FIG. 6.—Distal extremity of tibia of *Oxyæna morsitans* Cope. Both flesh-eaters and two-thirds natural size. From Report Expl. and Surv. W. of 100th Mer., G. M. Wheeler, IV, Pt. II.

FIG. 7.— End of tibia and astragalus of *Archælurus debilis*. FIG. 8.—Femur of *Nimravus gomphodus*. Carnivora, one-third natural size. Mus. Cope.

ception, and that is the distal metacarpal and metatarsal keels of the *Camelidæ* (figure 9). These animals confirm the probability of the keels being the effect of long-continued shocks, for they are the only Ruminants which have elastic pads on the inferior sides of their digits.

That these processes may be displacements due to shocks long-continued, is rendered probable by the structure of the bones themselves. (1) They project mostly in the direction of gravity. Constant jarring on the lower extremity of a hollow cylinder with soft (medullary) contents, and flexible end walls would tend to a decurvature of both inferior and superior adjacent end walls. If the side walls are wide and resistant, the projection will be median, and will be prolonged in the direction of the flexure of the joint. (2) They fit entering grooves of the proximal ends of corresponding bones. These will be the result of the same application of force and displacement, as the protrusion of the inferior, commencing with a concavity (*Elephas*); becoming

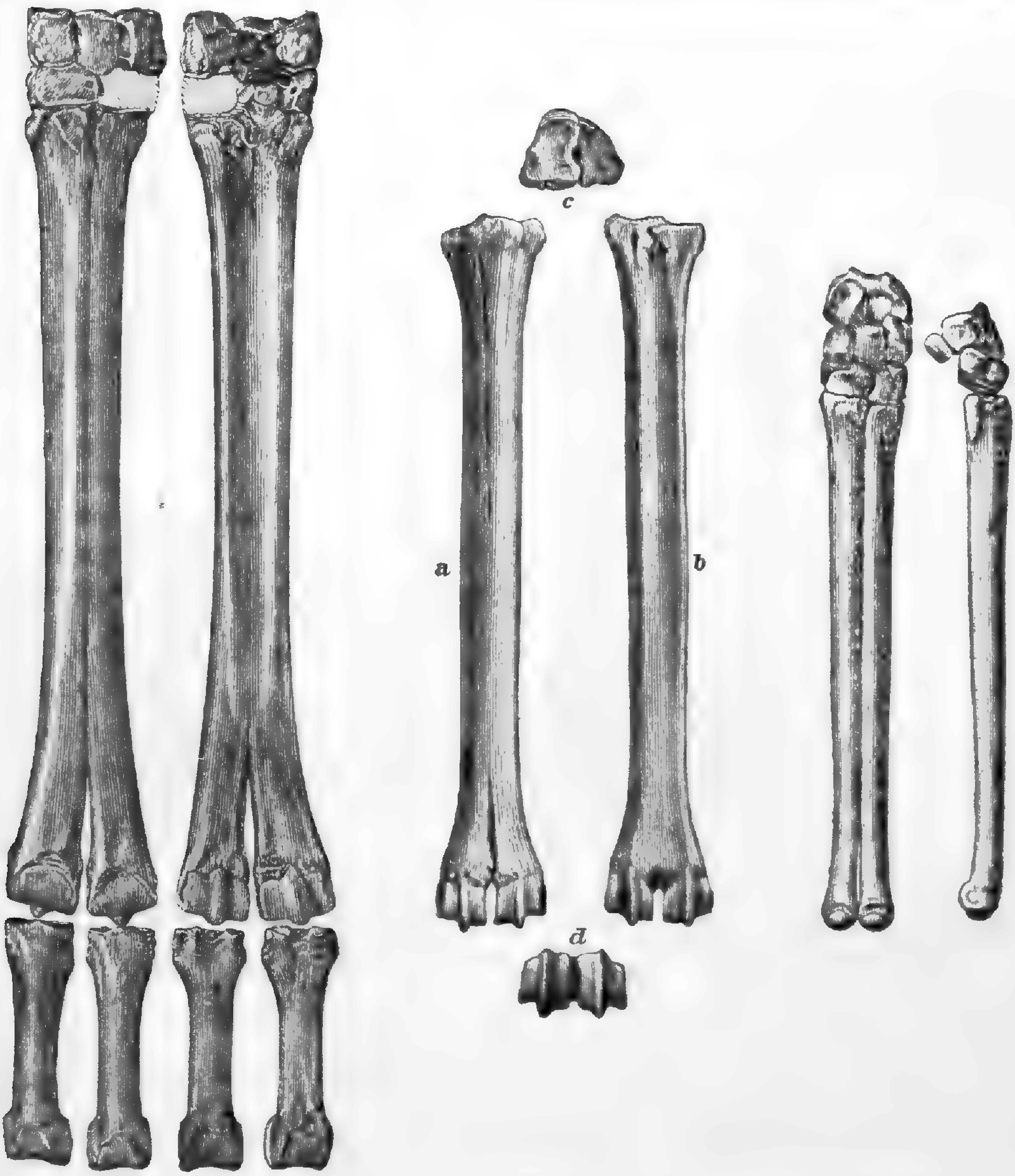

FIG. 9. FIG. 10. FIG 11.

FIG. 9.—Part of anterior foot of *Procamelus occidentalis* from New Mexico. From Report of Capt. G. M. Wheeler, Vol. IV, Pt. II.

FIG. 10.—Metacarpals of *Cosoryx furcatus* from Nebraska, two thirds natural size; *a*, anterior face; *b*, posterior; *c*, proximal end; *d*, distal end.

FIG. 11.—Left forefoot with part of radius of *Poëbrotherium wilsoni* Leidy, from Colorado, three-fifths natural size. From Hayden's Report, IV.

more concave (Fig. 7), and becoming finally a groove. (3) When the dense edge of a bone, as in the case of the lateral walls of the astragalus, is presented upwards, a groove is produced in the down-looking bone; *e. g.*, the lateral grooves of the distal end of the tibia. (4) When the inferior bones are the denser, the superior articular face yields; *e. g.*, the distal end of the radius to the first row of carpals (Fig. 11).

(5) The metapodial keels commence in the lower types on the posterior side of the distal extremity of the bone. This is partly due to the presence there of a pair of sesamoid bones, which with the tendons in which they are developed, sustain and press on the lateral parts of the extremities, and leave the middle line without support.

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EDITORS' TABLE.

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

—— Morphological biology treats of the relations of solid bodies of organic origin. These solid bodies are often in the highest degree irregular in form, as for instance, the squamosal bone, or the liver, of vertebrated animals. The mental handling of such material requires faculties which belong to the artist and the mechanic, together with a capacity for generalization not essential to either of those classes of specialists. The mastery of any considerable number of organic forms requires the exercise of a thorough analysis of them, which of course presupposes good perceptive faculties. The latter form the important class which furnishes material to the reflective department of the mind, and without which the grandest powers of thought wander aimlessly in the search of truth, for want of fundamental facts.

While a definite idea of the forms of organic bodies is necessary to the biological thinker, the power of describing them is necessary to the biological writer. It is absolutely essential that the describer of structure and form shall use language which is not susceptible of several meanings, and that he shall know how to express contrasts when describing different objects. It is not uncommon to find divisions or groups of various grades defined in somewhat the following manner: Div. I. Legs long; bill curved; Div. II. Tail truncate; legs scaly. On reading this, the inexperienced student is impressed with the occult wisdom of the oracle, while the scientist, on the other hand, feels his fulminate one degree denser than before. Our experience leads us to suggest that the faculty of analytical description sorely needs cultivation. It cannot be called a lost art until it shall have been found. Word painting is a high art, and the highest type of it is that which conveys to the mind of the reader a definite idea of the actual form of the object described. To accomplish this result ponderous nomenclatures have been created, and they are in a large degree necessary; but he displays the greater art who renders complex bodies as it were visible, by the use of the simple materials of ordinary language.

In view of the difficulties experienced by some in satisfying this necessity, much stress is laid, by many persons, on the importance of pictorial illustration. This we believe to be well, not only as a concession to the average of human capacity, but as greatly lightening the mental stress of the true scientist. Nevertheless there are three considerations in relation to this subject which have impressed us, and which we here venture to state:

(1) Pictures can never relieve an author of the necessity for good analytical description, because various points of an object cannot be shown by the number of representations which are within the reach of the average biologist. In the field of science the picture-maker may be a useful man, but he can never be a substitute for the analytical taxonomist.

(2) That pictures can never relieve the author from specifying the characters of his higher groups, as genera, families, etc., is self-evident.

(3) Iconography is only within reach of naturalists in proportion to their financial ability. Poverty should not condemn genius to inaction and obscurity.—*C.*

—— We have received a circular from the committee on instruction of the Academy of Natural Sciences of Philadelphia, asking for subscriptions towards the expenses of the next winter's course of lectures, and for endowments of some or all of the lectureships provided for in the by-laws of the institution. We hope this request will be liberally responded to by citizens, so that we may add to our various educational agencies, a course like that of the Jardin des Plantes of Paris.

We wish here to recall the fact that an academy of sciences can only introduce teaching as a collateral activity, as its primary object is original research. The professorships in question were not created for teachers only, but as positions for original investigators of distinguished merit. Such men will be generally good lecturers also. Should the council of the Academy appoint to these positions any but its first original investigators, it will be in danger of losing its character as an Academy of Sciences and its very *raison d'etre*. Every candidate for a lectureship should, therefore, be required to furnish a list of his papers descriptive of original discoveries he has made.

—— We have received the following from a distinguished correspondent:

ALBANY, MAY 14, 1881.

Gentlemen:—I have received the notice extracted from AM. NATURALIST, in reference to an invitation to the British Association for the Advancement of Science to meet in America in 1883.

I approve of the invitation, which it will be necessary to repeat before its acceptance.

It is well to begin the invitation in order that we may approach the object which sooner or later I believe will be accomplished.

Very truly yours, JAMES HALL.

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RECENT LITERATURE.

SEMPER'S AMIMAL LIFE AS AFFECTED BY THE NATURAL CONDITIONS OF EXISTENCE.[1]—The author's aim in preparing the lectures which he originally delivered before the Lowell Institute, at Boston, and which are here presented to the reading public, is expressed in the following words, to be found in the preface: "It appears to me that of all the properties of the animal organism, variability is that which may first and most easily be traced by exact investigation to its efficient causes; and, as it is beyond a doubt the subject around which at the present moment the strife of opinions is most violent, it is that which will be most likely to repay the trouble of closer research." Professor Semper, therefore, endeavors, and we think with a good degree of success, to present a general view of those facts and hypotheses which bear upon the subject, and which are either of universal significance or, from his own point of view, appear to offer favorable subjects for experimental treatment. The work is not an attempt at a general argument for the evolution hypotheses. If it was, a great many more views and facts might have been presented, but the value of the book is that it is mainly an original contribution to the general subject of evolution from the point of view of experiments on the relations between animals and their environment, which may be largely made in the laboratory, as well as in the field. The subject of endeavoring to account for the *origin* of the variations of species, of seeking for the efficient causes of variability, is not unfamiliar to American naturalists. Darwin professedly starts from the tendency to variation, and his theory, as such, ignores or opposes any thing like Lamarckianism or the influence of the environment on the organism. A few American writers have felt that we must endeavor to seek the causes inducing the tendency to variation, and have thus been led to what we may call a modified, scientific form of Lamarckianism. In order that the organism may undergo change

[1] *The International Scientific Series.* Animal Life as Affected by the Natural Conditions of Existence. By KARL SEMPER, Professor of the University of Würzburg. With two maps and 106 wood cuts. 12mo, pp. 472.

it must first be acted upon by a change in its surroundings, and the change must then be transmitted to its descendants. This is (1) modern Lamarckianism. Then, when the organism or set of organic forms are really in a stage of inequilibrium or of change, the principle or forces of (2) natural selection, or Darwinism, come in, eliminating the useless and preserving the useful forms. Thus Lamarckianism, in its modern shape, forms the base of the pyramid of evolution and Darwinism the apex. Lamarck and his followers (whether conscious of their intellectual descent from the learned and philosophic Frenchman or not) are endeavoring to lay the foundation. Meanwhile, Darwin and his English and German colaborers have began at the top and worked downward. While Professor Semper does not mention Lamarck, his entire line of thought is that of a modern Lamarckian, or what Lamarck would probably have been had he lived in the present half century. The work before us is not metaphysical, as is Darwinism. The term "natural selection" is seldom, if ever, completely personified as an efficient cause or active law, but we are, on the contrary, treated to the results, so manifold, of the effects upon animals of changed conditions of life by changes wrought artificially or in the laboratory of nature. The author, instead of taking up example after example, as do Darwin and especially his followers, and endeavoring to explain their variation by hypothesis piled on hypothesis, like the pile of metaphysical truths of old-school metaphysicians, which may be deftly demolished by removing the premise or undermost brick—the author, we say, works on the inductive method, and endeavors at least to plant his first brick on a substratum of facts tested by experiment. As Semper remarks at the end of his book, "No power which is able to act only as a selective and not as a transforming influence can ever be exclusively put forward as the proper efficient cause—*causa efficiens*—of any phenomenon. In all cases, including those of mimicry, the point finally must be to investigate the causes which may have availed to produce by their direct action any advantageous and protective change of coloring. It was not until the change had actually taken place that selection between better or worse endowed individuals could lead to the further development of the advantageous character. * * It becomes imperative that we should, in the first place, carry out the most exact research possible by means of experiment, and also wean ourselves of the convenient—but, as it seems to me, highly pernicious—habit of theoretical explanations from general propositions. Otherwise, there is great danger that the bright expectations which Darwin has opened out to us by his theory may be baffled—the prospect of gradually bringing even Organic Being within reach of that method of inquiry which seeks to discern mechanical efficient cause."

How the author has carried out his intentions may be seen by a perusal of the chapters which treat of food and its influence, the influence upon animals of light, of temperature, the influence of stagnant water, of a still atmosphere, of water in motion, or currents, as a means of extending or hindering the distribution of species, and, lastly, on the transforming influence of living organisms on animals, and the selective influence of living organisms on animals. Unless we are mistaken, the method of studying the causes of evolution, *i. e.* by observation and experiment, will be in the end far more sound and fruitful than those of pure, metaphysical Darwinism, as it tends to become in the hands of ultra Darwinians. The methods are more like those of the physical and mathematical astronomer. Zoölogy will, in consequence be more of an exact sclence and possess more real interest and value in the eyes of the masses than it now does.

The chapters on the influence of light and of temperature are particularly suggestive. So is the fifth chapter, on the influence of stagnant water, which embraces the results of the experiments of Schmankewitsch on the brine shrimp; also those of Semper on the effect of changes in the volume of water on the pond snail. The portion which is quite novel, and which will attract general attention, is Semper's theory of the origin of coral islands. He attempts to show that the connection between the strength and direction of ocean currents, and the vigor of growth in the corals and in the reefs they form, is one of the principal causes that have given the reefs their frequently very remarkable forms. This view is, he claims, in direct contradiction to Darwin's theory of subsidence, as well as Dana's theory. It is more of a piece with Moseley's theory recently proposed, although it is not impossible that Darwin's, as well as Dana's, on the one hand and Moseley's and Semper's on the other, may all be the terms of a series of causes.

The book teems with facts which will be new to most of our readers, and hence it is a solid contribution to the evolution theory. Compared with Oscar Schmidt's crude and one-sided presentation of Darwinism, in his little book entitled Descent and Darwinism, Semper's will remain a classical work, from its basis of well-grounded facts.

Without careful search for errors we notice that under the head of hybridism several cases known in the United States among the deer and Salmonidæ are not referred to (perhaps they were not accessible to the author), while the statement that several species of insects produce hybrid offspring may, if we mistake not, be modified, since about one hundred such cases are on record. The singular Branchipod genus Thamnocephalus cannot be said to occur in the "South of the Union," for its only known habitat is Kansas, on the eastern edge of the Rocky Mountain plateau. We notice a few typographical errors, and the index is too short and quite defective.

Anniversary Memoirs of the Boston Society of Natural History.—Following the example of German scientific societies, the Boston Society of Natural History has published a thick quarto volume of memoirs, contributed by its members and designed to commemorate the fiftieth anniversary of the society's foundation. The scientific portion is preceded by a minute, detailed history of the society by its late president, Thomas T. Bouvé, Esq., which will possess great interest to the immediate friends of the society, and will also serve as a monographical account of the origin and development of our most vigorous and model natural history society. It appears that the enthusiasm, zeal, and unremitted and unpaid toil of its founders, together with the high scientific character of its president and officers, and more particularly the influence of the late Professor Jeffries Wyman, led men of wealth and refinement to liberally endow it. The following memoirs are contained in this elegant volume, and have in part been noticed in this journal, while others will be hereafter. Mr. Bouvé's history occupies 250 pages, and is illustrated with two plates and nine portraits. The following is the table of contents:

Propositions concerning the classification of lavas considered with reference to the circumstances of their extrusion, by N. S. Shaler (15 pp.); The genesis of the Tertiary species of Planorbis at Steinheim, by Alpheus Hyatt (114 pp., 9 pl.); The Devonian insects of New Brunswick, by S. H. Scudder (41 pp., 1 pl.); The Gymnosporangia, or cedar-apples, of the United States, by W. G. Farlow (38 pp., 2 pl.); A structural feature, hitherto unknown among Echinodermata, found in deep-sea Ophiurans, by Theodore Lyman (12 pp., 2 pl.); The development of the squid, *Loligo pealii* Lesueur, by W. K. Brooks (22 pp., 3 pl.); The anatomy, histology and embryology of *Limulus polyphemus*, by A. S. Packard, Jr., (45 pp. 7 pl.); On the identity of the ascending process of the astragalus in birds with the intermedium, by E. S. Morse (10 pp., 1 pl.); Contributions to the anatomy of the milkweed butterfly, *Danais archipus* Fabr., by Edward Burgess (16 pp., 2 pl.); Studies on the tongue of reptiles and birds, by C. S. Minot (20 pp. 1 pl.); Notes on the crania of New England Indians, by Lucien Carr (10 pp., 2 pl.); The feeling of effort, by William James (32 pp.); On the development of a double-headed vertebrate, by S. F. Clarke (6 pp., 1 pl.).

Brooks' Development of the Squid.—In this paper, which is reprinted from the Anniversary Memoirs of the Boston Society of Natural History, Professor Brooks describes and figures many of the stages in the development of the common squid, *Loligo pealii*, observed by him at the mouth of Chesapeake bay. The development is remarkably direct, there being no approach to a metamorphosis. The method of formation of the shell area and of the shell, the mode of origin of the mantle and of the mantle cavity, and the form and position of the gills of the Cephalopod embryo are more closely like those of the typical Gasteropod than are to be inferred from the condition of these organs in the adult, and thus enable us to better understand the homology between the Cephalopod and a typical Mollusk than before, as first shown by Grenacher, while Professor Brooks has discovered several additional stages which enable him to correct some of Grenacher's conclusions and to fill up the gaps in the evidence bearing on this subject. The yolk sac Professor Brooks regards as the homologue of the gasteropod foot; the arms of the Cephalopods have no homologues in the Gasteropods, but may, perhaps, be the equivalents of the "cephaloconi" of the Pteropod, Clio; Brooks also believes that the siphon is a structure peculiar to the Cephalopods, with no equivalent in the Gasteropods. The views of Huxley, Grenacher and Von Ihering are presented, with the author's reasons for agreeing with or dissenting from them.

Second Report of the U. S. Entomological Commission.[1]—This volume of four hundred pages gives the results of the labors of the Commission during the years 1878 and 1879. It is divided into fourteen chapters, of which the most are of a practical nature relating to the following subjects: Additions to the chronology of locust ravages; the relation of the locust and its ravages to agriculture and the settlement of the Territories; facts concerning and laws governing the migrations of locusts in all countries; habits and characteristics of locusts in all countries within the areas of permanent distribution, so far as these relate to their movements; influence of meteorological conditions on the development and migrations of locusts; the southern limits of the distribution of the Rocky Mountain locust; summary of locust flights from 1877 to 1879: locust ravages in California; and courses that may be adopted by the General Government to lessen locust injury. The more purely technical and scientific chapters are those on the histology of the locust and Anabrus, by Dr. C. S. Minot, illustrated with seven plates; the brain of the locust, by A. S. Packard, Jr., with seven plates; and further facts about the natural enemies of the locust, by C. V. Riley, with a colored plate. A chapter on the western cricket, often so destructive to vegetation in the Western Territories, is inserted, with an illustrated account of the internal and external anatomy of Anabrus; while the appendix contains the description of a number of new species of grasshoppers collected by the Commission in the West, prepared by Mr. S. H. Scudder, and illustrated with a lithographic plate.

[1] *Department of the Interior. Second Report of the U. S. Entomological Commission for the years 1878 and 1879*, relating to the Rocky Mountain Locust and the Western Cricket, and treating of the best means of subduing the locust in its permanent breeding grounds, with a view of preventing its migrations into the more fertile portions of the Trans-Mississippi country, in pursuance of appropriations made by Congress for the purpose, with maps and illustrations. Charles V. Riley, A. S. Packard, Jr., and Cyrus Thomas, Commissioners. Washington, 1880. 8vo, pp. 322, appendix 80, with seventeen plates.

The third report of the Commission has been ordered by Congress, while a fourth upon the cotton worm and other cotton insects is in preparation. Five bulletins have appeared and three others are either in press or nearly ready for the printer. These bulletins will eventually form a volume relating entirely to practical or applied entomology.

RECENT BOOKS AND PAMPHLETS.—Ueber eine Sammlung von Fischen, welche Hr. Dr. Gerlach in Hong Kong gesant hat. Prof. W. Peters, Akademie der Wissenschaften zu Berlin. 8vo, pp. 10, plate. Berlin, Dec. 13, 1880. From the author.

Fuhrer durch die Geologischen Sammlungen in Museum des Königreiches Böhmen in Prag. Dr. Ant. Fric. 8vo, pp. 40. Prag, 1881. From the author.

Catalogue des Mammiferes vivants, et Fossiles, Rodentia (Suite). 8vo, pp, 70. Paris, 1881. From the author.

Les Petit Mammiferes de la France. Procedés pour capturer et reunir en collections les Mammifeies. Par Dr. M. Trouessart. 8vo, pp. 16, plate. Paris, 1881. From the author.

On the structure and affinities of the genus Monticulipora and its sub-genera. With critical descriptions of illustrative species. H. Alleyne Nicholson, M.D., D.Sc., F.R.S.E., F.L.S. Royal 8vo, pp. 244, cuts, 6 plates. Bound. Edinburgh and London, 1881. From the author.

Meteorological Report, 1880, including returns for 1877, 1878, 1879, and averages for previous years. Director James Hector, M.D., C.M.G., F.R.S. Colonial Museum and Geological Survey Department. 8vo, pp. 116, plates 3. Wellington, 1881. From the author.

A Memorial of Joseph Henry. Published by order of Congress. Royal 8vo, pp. 530. Engraving. Gov. Printing Office, Washington, 1881.

Osteology of Speotyto cunicularia, var. hypogæa and of Eremophila alpestris. R. W. Schufeldt, Acting Assistant Surgeon U. S. Army. 8vo, pp. 66, cuts, plates 4. Department of the Interior. Gov. Printing Office, Washington. From the author.

The Rocky Mountain Locust. Permanent courses for the Government to adopt to lessen or avert Locust injury. Charles V. Riley, M.A., Ph.D. 8vo, pp. 22, maps 6. Government Printing Office, Washington, 1881. From the author.

Census Bulletin, No. 141. 4to, pp. 4. Gov. Printing Office, Washington, 1881.

Proceedings of the United States National Museum. 8vo, pp. 31. Washington, 1881.

Bulletin of the Museum of Comparative Zoology, of Harvard. Vol. VIII, No. 8. Studies of the Jelly-fishes of Narragansett bay. J. Walter Fewkes. 8vo, pp. 41, plates 10. Cambridge, 1881. From the author.

Biographical Sketch of Louis Francois de Pourtales. Alexander Agassiz. 8vo, pp. 12. Cambridge, 1881. From the author.

Geological Notes. I. Taconic system in Geology. II. The Genesis of certain Iron ores. III. The Origin of Anthracites. IV. The recent formation of Quartz and the silicification of Wood. T. Sterry Hunt, LL.D., F.R.S. 8vo, pp. 8. Montreal, Jan. 20, 1881. From the author.

"Beiträge zur Kenntniss der Flussfische Süd-amerika's (III)" und "Ichthyologische Beiträge (XI)." Director Dr. Steindacher. From the Sitzung der Mathematisch Naturwiss. Classe Akad. Vienna. Vom 5. Mai, 1881. 8vo, pp. 15. From the author.

Illustrations of the Earth's Surface. Glaciers. Nathaniel Southgate Shaler, Professor of Palæontology, and William Morris Davis, Instructor in Geology in Harvard University. 4to, pp. 200, cuts, plates XXV. Boston, 1881. From J. B. Lippincott & Co.

Bulletin of the Museum of Comparative Zoölogy at Harvard College. Vol. VIII, No. 9. List of Mammals collected by Dr. Edward Palmer in Northeastern Mexico, with field notes by the collector. By J. A. Allen. 8vo, pp. 17. Cambridge, 1881. From the publishers.

Proceedings of the United States National Museum, 1881. Check list of duplicates of fishes from the Pacific coast of North America, distributed by the Smithsonian Institution in behalf of the United States National Museum, 1881. Prepared by David S. Jordan and Pierre L. Jouy. 8vo, pp. 48. Washington, Gov. Printing Office.

Proceedings of the United States National Museum (1881.) Notes on the Fishes of the Pacific coast of the United States. By David S. Jordan and Charles H. Gilbert. 8vo, pp. 46. Government Printing Office, Washington, 1881.

Geological Survey of Alabama, Report of progress for 1879 and 1880. Eugene A. Smith, Ph.D., State Geologist. 8vo, pp. 158, with map. Montgomery, Ala., 1881. From the author.

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GENERAL NOTES.

BOTANY.[1]

THE GROWTH OF STARCH GRAINS.—At the suggestion of the editor of this department, I have prepared the following résumé of the results of my recent investigations. A fuller account appeared in *Bot. Zeit.*, 1881, No. 12 *et seq* (Untersuchungen über das Wachsthum der Stärkekörner).

The investigation of the development of starch grains yields several facts altogether unreconcilable with the well known theory of Nägeli, according to which they grow by intussusception. It was found that the middle part of the grain is formed first and the outer parts successively deposited around it. This is shown by the characteristic corroded structure of the small grains of many young organs, which can still be recognized very easily in the central part of the old grains, and by the comparison of grains of different age.

The corroded structure is due to the well-known circumstance that the starch of young plant-organs is only a transitory deposit which is partially used up again for the formation of cell-walls. The storing up of definitive starch begins only when the organ has reached its definitive size, and takes place partially around the remnants of the transitory grains, and partially by the formation of new grains which are of spherical shape and of course without any corroded appearance. These statements were based on observations made principally upon the starch grains of the cotyledons of *Dolichos Lablab*, *Vicia Faba* and those of the stem of *Cereus speciosissimus*.

Nägeli's theory, however, seemed to be firmly established by the following properties of starch-grains: (1) Their being made up of regularly alternating more and less watery layers, the outermost being always least watery (densest). (2) The difference of consistence between small grains and the middle part of the large ones, the first being very dense, the latter very watery. (3) Their unequal growth in different directions. (4) The growth of compound and half compound grains being, according to

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

Nägeli, strongest between the nuclei, while growth by apposition would only take place at the periphery of the grains. (5) The partial grains of compound and half compound grains being more watery than simple grains of similar size.

In the discussion and explanation of these properties, the remarkable inner differentiation of starch-grains is first considered. The development of simple granules which was found to agree in the most important points with the observations of Nägeli, excepting the peculiar properties above referred to and belonging to a limited number of plants, may be summed up as follows: (1) Young grains consist of very dense, highly refractive substance. (2) Later a less refractive, more watery spot (nucleus) appears in the center. (3) More aged grains have three or several layers, the outermost being always very dense and highly refractive. (4) The inner substance becomes more watery as the grains increase in size.

According to the generally adopted views of Nägeli, these facts are held to prove that the inner structure is not due to a successive deposit of alternating more and less dense layers around a highly watery primary grain, but that the more watery layers and the nucleus have been differentiated within the less watery substance. The investigation of the physical properties of starch-grains leads, however, to an explanation of these properties which by no means requires the adoption of the theory of growth by intussusception. These properties are the following: (1) Starch grains are rather brittle parallel to the layers, but very extensible perpendicularly to them. (2) Cutting, crushing or extension causes the dense starch-substance to swell up considerably and to take all the properties of the more watery parts of intact grains. (3) Swelling up in water is much stronger parallel to the layers than perpendicularly to them.

Nägeli holds that the tensions, the presence and intensity of which he clearly recognized, are due to the intercalation of new starch molecules being greater in the tangential than in the radial directions; according to him these tensions would cause the formation of a central cavity in the homogeneous young grain, and later the division of the dense layers; and in the so-formed spaces a deposit of watery starch would take place. These views have not been confirmed; firstly, as to the cause of the tensions, which are due not to the unequal intercalation of starch-molecules, but to the unequal swelling up in different directions; secondly, as to the formation of a cavity and clefts in the homogeneous grains. The properties of starch granules above referred to, show that in such circumstances not a breaking but only an extending of the substance would take place, this causing the dense substance to become more watery and less refractive; for such places, therefore, where the tensions are strongest (viz., the central part of the grain and the middle parts of the peripheral dense layers after their reaching a certain thickness by apposition growth), the transformation of less watery to more watery substance will be performed; in other words, the nucleus and the less dense layers will appear. That the inner parts of the grains, taken as a whole, are less watery than the peripheral ones, is due also to their being extended by the latter.

The unequal growth of starch-grains in different directions was shown in a former paper[1] to be due to the unequal conveyance of material. Starch-grains which are formed in the inner parts of chlorophyll or starch-forming granules, and remain surrounded by them, have central nuclei. They become eccentric when they are formed at the periphery of chlorophyll or starch-forming granules, and show constantly the greatest growth where they are in contact with them.

The formation of compound grains was also described in the paper already quoted, and shown to be due to the growing together of free granules, and not, as Nägeli holds, to the division of simple grains. The development of half compound grains was investigated principally in the rhizome of Canna and found to be analogous. The structure of grains having their nuclei distant from each other, which led Nägeli to suppose an intense growing of the grains between them, is caused by their being formed at distant spots upon the periphery of the chlorophyll, or starch-forming granules. The differences in the density of simple grains and the partial grains of the half compound and compound ones, is due to the extension of the inner by the outer parts.

Nägeli, and after him most biologists, hold that starch-grains agree with protoplasm as to their molecular structure, and are to be considered as living bodies. There is no longer any reason for ascribing to them properties different from those of inert bodies; their cohesion and their optical properties prove conclusively that they are sphærocrystals; they differ from most crystals by their property of swelling up in water, but the so-called protein crystalloids, which agree with them in this property, are known to be crystals of proteic substances, and have been produced artificially under the same circumstances in which true crystals would have been formed.[2]—*A. F. W. Schimper, Johns Hopkins University.*

Hardiness of the Eucalyptus.—The paragraph on p. 389 of the Naturalist for May, requires qualification; what Baron Mueller no doubt said, was, that in the native places of growth the blue gum was uninjured sometimes when the thermometer fell to 20° or 15° Fahr. Luminose and hygrometrical conditions in connec-

[1] *Botanische Zeitung*, 1880. Translated in *Quarterly Journal of Microscopical Science*, April, 1881.

[2] These conclusions are based upon the researches of Schmiedeberg (*Zeitschrift für physiol. Chemie*, Vol. I), Drechsel (*Journal für praktische Chemie*, Vol XIX) and my own investigations (*Zeitschrift für Krystallographie*, Vol. V).

tion with thermometrical—indeed, all that we understand by the word climate, decide hardiness. In this case the *Eucalyptus globulus* will not stand even a white frost in many parts of the United States. In a letter to me Baron Mueller says that *Eucalyptus amygdalina* and *E. Gunnii* stand a much lower temperature in their own homes than the common blue gum, and are now being used to replace the celebrated plantations on the marshes near Rome, which were destroyed during the winter of 1879–80.—*Thomas Meehan.*

Curiosities in Tree Growth.—Some years since a gentleman in New Jersey pointed out to me what he thought to be a curious case of natural grafting. One of the boughs of a maple tree *(Acer rubrum)* had thrown off a branch which after growing to a length of several feet without branches, had again united with the parent bough, the two forming a smooth and perfect union. The matter was discussed among some friends distinguished alike in horticulture and botany, and it was decided that such a thing could not take place naturally. Recently a similar case has come to my notice in a tree whose location, in a remote portion of Arizona, places it almost beyond possibility that human agency could have been concerned. The tree is a variety of oak, common here, which no botanist seems at present willing to assign to any species.

As represented in figure 1, the bough forks at the point *a*, about three feet from the trunk. The two branches, after running nearly side by side for a distance of three feet, come together at

Fig. 1.

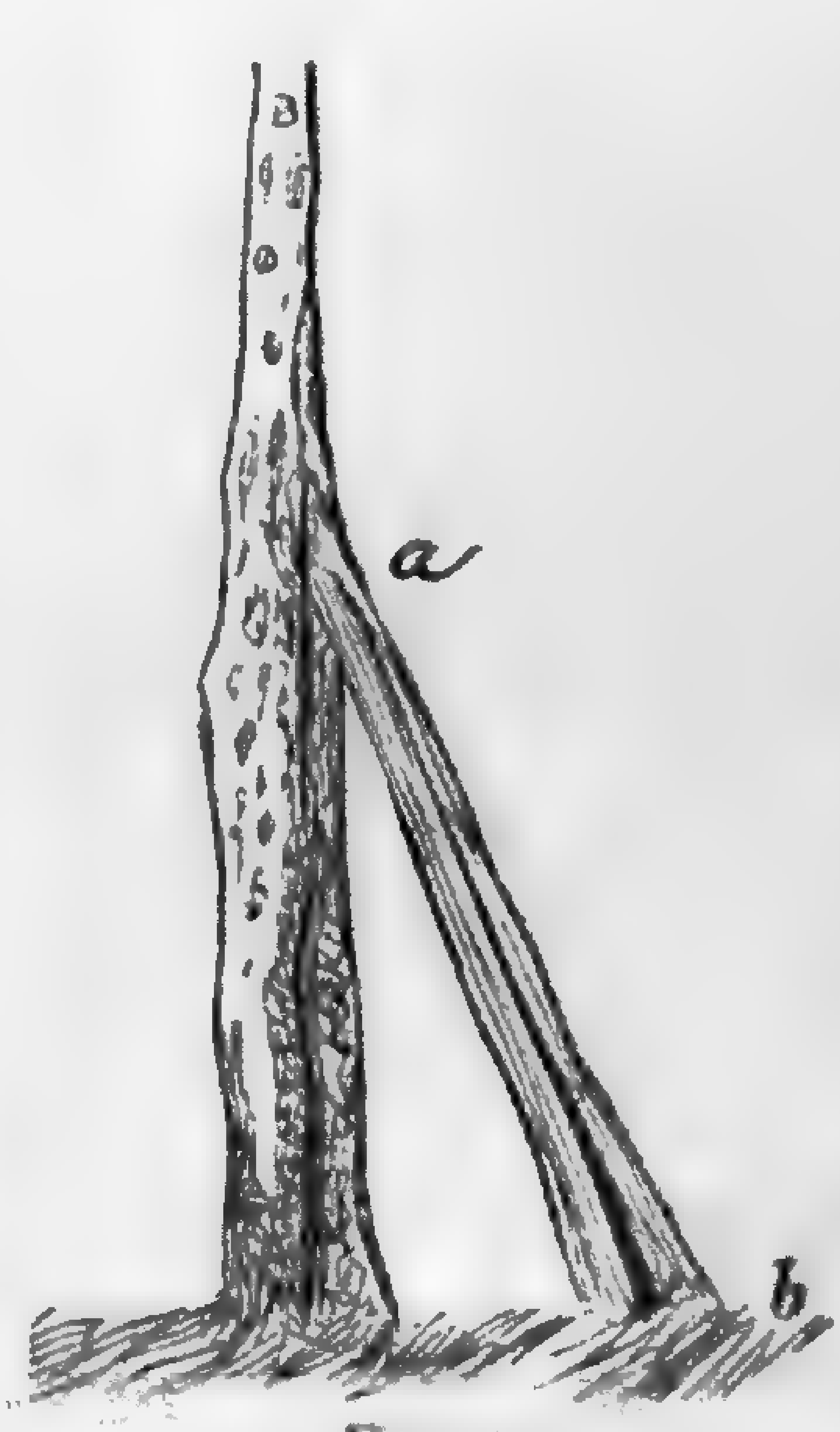

Fig. 2.

b, forming a smooth and perfect union. As the bough is dead and bared of its bark, the fibers of the wood can be seen with great distinctness. The "crotch" at *b* presents precisely the same appearance that it would were the parent trunk toward *b*, forking in the direction of *a*. It is worthy of note that the bough beyond *b* has about the same diameter as inside of *a*, while at the branching part the wood is about equally divided between the two branches.

This interesting specimen has been forwarded to the Smithsonian Institution, where it may be seen.

Near this tree grows another, represented in figure 2, a specimen of *Platanus racemosa*, the sycamore of this section. Growing on the bank of the stream which runs through the bottom of a deep cañon, it seems to have been broken down by some of the rubbish carried against it during the rainy season. Breaking upon the upper side, a large mass of wood has been separated from the bark and protruded through the aperture. Later the tree has resumed the erect position. At the present time the entire cavity has been filled with new wood, and all traces of the wound bid fair to disappear. The mass of rubbish which has accumulated at the base of the tree gives the portion *a–b* the appearance of having been elongated.

Possibly such wounds are more readily healed in this country, owing to the irregularity and frequency of the periods of growth, corresponding to the great irregularity in the seasons of heat, cold, drouth and moisture.—*Henry H. Rusby.*

Botanical Notes.—The Characeæ of North and South America are now under a fair way to be elaborated systematically. Dr. T. F. Allen, of 10 E. 36th street, New York, who has already done such good work for some of our species, is making arrangements for enlarging the scheme of his *exsiccatæ* and illustrations so as to include the South American species. He requests all collectors to secure good specimens for him, and for those from South America he will make arrangements to pay liberally.——It is a genuine pleasure to call attention to the increasing usefulness of microscopical journals. The publishers of the *American Journal of Mircroscopy* deserve the thanks of students and teachers of botany for republishing, in the April number, a lecture on "How to examine a plant microscopically," by H. Pocklington (Leeds, Eng.). The article, which occupies eight pages, is a most excellent one, and cannot fail to do much good.——I. C. Martindale, of Camden, N. J., has issued a neat Catalogue of Desiderata (21 pp.), which may prove useful to other botanists also.——Professor Harvey's Classified list of the ferns of Arkansas, reprinted from the *Botanical Gazette*, enumerates thirty-nine species, and gives their range throughout the State.——Professor Dickson's paper on the morphology of the pitcher of *Cephalotus follicularis* in the *Journal of Botany* for May is interesting. He concludes "that the pitcher results from a calceolate pouching of the leaf-blade from its upper surface" somewhat as in the nectariferous petal of Aconitum, or as is shown better still in the petals of Aquilegia.

Incidentally he refers to the pitcher of Sarracenia as "corresponding morphologically to a peltate leaf like that of Nelumbium," but with the hollowed out depression of the upper surface much deepened and narrowed.——Morren's *Correspondance Botanique*, 8th edition, is a valuable aid to the botanical collector as well as the general botanist, giving as it does the address, title and special line of work of the more prominent botanists and collectors in all parts of the world.——We shall be doing a good service to many students by calling attention to the catalogue of works on natural history, just issued by Bernard Quaritch, 15 Piccadilly, London. Many rare and valuable botanical books are offered at moderate prices.——An important work, "Eléments de Botanique Fossile," by Edouard Bureau, is announced by the Paris booksellers as about ready.——Peter Henderson, well known for many years as a prominent horticulturist, has just published a "Handbook of Plants," which is designed to serve as a dictionary, or reference-book for the plants in cultivation either for use or ornament. It is especially adapted to this country, and is thus more valuable for Americans than Paxton's, Loudon's or Lindley's works. The arrangement is alphabetical for easy reference, but the natural order is indicated in every case. Instructions as to the best modes of cultivation are given in many cases, in addition to short descriptions of the plants. Not only will this book prove valuable to the horticulturist, but in many cases the botanist will find it indispensable also.

ZOÖLOGY.

The king snake (Ophibolus sayi) sups on a full grown water moccasin (Ancistrodon piscivorus).—"Be ye therefore wise as serpents."—Matt. x, 16.

The non-venom-secreting Ophibolus and the deadly Ancistrodon had kept a friendly companionship for several days in the same prison box. Well aware of each other's peculiar method of self-defence, there had been a policy truce instituted for the nonce. The former did not relish a hypodermic injection of poison from his surgeon neighbor, and the latter equally as much dreaded a fraternal embrace from his acrobatic companion. The one abhorred convulsions and tetanoid calisthenics as much as the other deprecated triturated ribs and macerated scales. The sky became suddenly changed, and such a change! &c., *vide* Byron. Without warning, the king snake instantly whipped a coil or two of its tail around the neck of his neighbor, just as the cracker of a whip doubles into a knot by the movement of the staff in the hands of a deft coachman. Before the moccasin could recover from the shock, its entire body was tightly pressed by the reduplicating folds of its agile enemy. From neck to tail and back again, its entire length was tied up so effectually that respiration became difficult, movement of the body was out of question excepting a vibrating tremor passing helplessly from nasal tip to tail tip, and a swift contracting of the assailant's convoluting folds assured the victim of broken ribs and speedy helplessness. The mouth of the moccasin was open, though the bifid tongue could not dart forth, the lower jaw hung livid, and the strength left in the upper maxillary was insufficient to allow the poison fangs to erect themselves. Suffocation and broken ribs were too much even for a deadly snake to withstand. These facts were closely noted by our acute Ophibolus who slowly uncoiled himself from the neck of the vanquished, and withdrawing his head a few inches so as to notice the features of his prey, he advanced for the banquet. The stunning blow being felt, the moccasin had closed his mouth and was apparently resigned to his fate. Fastening his upper teeth upon the occipitals, and distending his os quadratum, the king snake held the head of his victim in his mouth, the tail of the latter still wriggling uneasily. The coiling became tighter and tighter, a slight noise like the crackling of bones was heard, accompanied by a tremor which shook both alike, and the two, victor and vanquished, now twisted up in a labyrinthine knot, rolled over and over like a spent ball from a cannon.

Taking them from the box, I uncoiled and stretched them out on the floor where they appeared like a double tailed snake without a head. This gave relief to the moccasin who, although his head, as far as the atlas, was firmly held between the jaws of his antagonist, wriggled manfully with renewed strength obtained by a release from the constrictor's folds. The king snake was now at a disadvantage, as noted from the movements of his tail. A stick was placed near it, around which it was instantly coiled to the *extent* of six inches, and with this purchase power he felt at ease. The ribs of the moccasin were effectually crushed, and the process of swallowing him was now easier and more rapid. About sixteen inches of the victim's body being stored away in the expanding stomach of the happy constrictor, a quantity of chloroform was administered to the gourmand, and in this position the two specimens are now preserved in my cabinet.

The length of the king snake was forty-two inches, and that of the moccasin thirty-four inches, the body of the latter being much larger than that of the former. The time occupied in this half-way repast, was two hours.

Only a scientific consideration prompted me to destroy and dissect my useful cannibal, for he had already eaten seven other snakes while in captivity.

This note must be added. Ophiophagi, or snake eating snakes, prefer other victims, and prey on their own species only on account of the absence of their regular food.—*John T. Humphreys, Burke Co., N. C.*

SURVIVAL OF WILD HABITS IN DOMESTICATED CATTLE.—One would suppose that Jersey cattle, which are probably the oldest domesticated breed, and which are noted for being such docile and gentle pets, had outgrown all traces of their wild habits; but I have frequently noticed some traits in my herd, which seem to me to be a survival of their wild habits away back in far distant times. For instance, in going to or returning from the pasture, the strongest cow or bull heads the procession, and the weakest or youngest calves bring up the rear. This order of movement is seldom varied, and it would seem to have been necessary for the protection of the weaker members of the herd in a wild state. Then, it often happens that those in the rear, as they are being driven to pasture, are lazy in their movements, and it is sometimes difficult to urge them along. But turn out and leave one or more such animals behind! They quickly find the use of their legs, and very soon gallop up to the herd, the protection of which they no doubt think they need. Choice grass and a good appetite are alike unavailing to keep them back when the herd is moving away! Again, they sometimes all take a notion to walk very slowly and linger by the way, even when much urged to go forward. At such times let a man come up behind them on a run, making a clattering noise with his feet, and without other effort the herd will prick up their ears and break into a trot. When moping over the ground, such a noise behind them will arouse them to life and movement at once. Horses act very much in the same manner when they suddenly hear the clattering of feet along the ground. It has seemed to mé that in their wild state they must have learned that this noise indicated the near approach of danger, either from the apprehension of enemies, or from fright among their own associates, and that the habit has survived the necessities which called it into existence. Such peculiarities, though not specially important or noteworthy in themselves, would be more marked and decided in a wild state, and what we see now is but a faint trace of the alert habits of their old time predecessors.—*Chas. Aldrch, Webster City, Iowa, 1881.*

A DOG'S DISCRIMINATION OF SOUNDS.—My neighbor's dog, "Shep," used to stay at my place about as much as at home. He was of mixed blood—probably Newfoundland, shepherd and water spaniel—and very sagacious and tractable. A bridge crosses Boone river just below my residence, and below this bridge there are perhaps two hundred acres of timbered land, which is uninclosed and used for common pasturage. One of my cows wore a heavy deep-sounding bell, which could easily be heard a mile. Upon several occasions I sent "Shep" after the cows and he always brought them—and frequently after dark. My plan was to go and stand upon the high bridge and listen, keeping "Shep" close by my side. Upon catching the sound of our bell among a dozen others, as it came up rather indistinctly through the trees, I would say: "There, 'Shep,' that is our bell; go and get the cows!" As soon as he seemed to feel sure of the sound he would start off upon a run, and it would be but a few minutes until I would hear the bell coming towards home. From many trials I satisfied myself that he could distinguish the sound of our bell as far as I could myself. He could doubtless have been trained to do many such tasks, but he had had little or no training of any kind, and this instance that I have stated seemed to have been understood by him as a matter of course, and had not come through any special effort or discipline.—*Chas. Aldrich, Webster City, Iowa, 1881.*

DISCOVERIES IN THE ANATOMY OF CRUSTACEA.—Herr. Nebeski in his contributions to our knowledge of the Amphipoda of the Adriatic,[1] adds considerably to our knowledge of the anatomy and histology of these forms. He first discusses the glands in the legs of certain forms first pointed out by Prof. Smith.[2] Next the urinary glands, which are found at the posterior portion of the alimentary tract are investigated. Following this comes an account of the structure of the gills and the rectum of Orchestia. The next point discussed is the fact that certain portions of the testes of Orchestia produces eggs, and our author says: "we have here in general (überhaupt) no hermaphrodite gland, but the organ corresponds *in toto* to the testes of the allied Amphipoda, and shows only the remarkable exception *that a definite portion of the genital layer produces eggs.*" The article concludes with a review of the Amphipod fauna of Trieste.—*J. S. Kingsley.*

EFFECTS OF DIFFERENT COLORED LIGHT ON THE GROWTH OF ANIMALS.—Various persons have experimented upon the effects of different colored light upon the growth of animals, and have universally found that animals develop at different rates under the influence of the different colors. M. Yung in his recent investigations on the eggs of frogs, trout and Lymnæa,[3] found that they developed in the following order, the violet accelerating and the red retarding:

	Violet.
	Blue.
These two colors acted in nearly the same manner.	Yellow.
	White.
	Red.
	Green.

—*J. S. K.*

ZOOLOGICAL NOTES.—The Proceedings of the United States National Museum, just issued, contain a check-list of duplicates

[1] Otmar Nebeski, Beiträge zur Kenntniss der Amphipoden der Adria. Arbeiten aus dem Zool. Inst. Wien, III, pp. 1–52. pls. 4, 1880.

[2] Tube building Amphipoda. *Am. Jour. Sci.*, III, VII, p. 601, 1874.

[3] De l'influence des lumières colorées sur le développement des animaux—Mittheilung Zool. Station Neapel, II, p. 233, 1880.

of fishes from the Pacific Coast of North America, distributed by the Smithsonian Institution, in behalf of the National Museum, to different college museums. These collections are of great value, comprising many rare typical forms, and will do much towards the progress of ichthyology. Valuable notes on the fishes of the Pacific coast by Messrs. Jordan and Gilbert appear in the same periodical.——Among ornithological papers in the signature of the same Proceedings, issued April 13, 1881, is the description of a duck, *Fuligula rufina* (Pallas), which is new to the United States, having been found in the New York market, and supposed to have been shot on Long Island sound——From his extended observations on the food of the fresh-water fishes of Illinois, Mr. S. A. Forbes is impressed with the "supreme importance of Entomostraca and the minute aquatic larvæ of Diptera as food for nearly or quite all of our fresh-water fishes, a conclusion that gives these trivial and neglected creatures, of whose very existence the majority of people are scarcely aware, a prominent place among the most valuable animals of the State, for without them all our waters would be virtually depopulated." He also brings out the interesting conclusion that a prolific species having an abundant food supply, and itself the most important food of predaceous fishes, may, by extraordinary multiplication, so diminish the food of the young of the latter as to cause, through its own abundance, a serious diminution of the numbers of the very species which prey upon it. It is not certain that the excessive increase of the gizzard shad would, by eventually reducing the supply of Entomostraca, cause a corresponding reduction in the numbers of all the species of that stream by starvation of the young; and this decimation, applying to all in the same ratio, would take effect upon the ordinary number of the other species, but upon the extraordinary number of the gizzard shad, would reduce the other species below the usual limit, but might not even cut off the excess of the shad above that limit. Consequently, important as is the supply of food-fishes for the predaceous species, it is not less important that the predaceous species should be supplied to eat up the food.——The third volume of Dr. G. S. Brady's Monograph of the Copepod Crustacea of the British Islands, published by the Ray Society, has appeared. This valuable and fully illustrated work will be welcomed by those in the United States interested in the Entomostraca.——The Transactions of the Kansas Academy of Science, for 1879–80, just issued, contain some important faunal entomological lists by Prof. F. H. Snow, of Kansas, Colorado and New Mexico; articles on the Batrachian reptiles of Kansas, by F. W. Cragin; and notes on the birds of Riley county, Kansas, by Dr. Blachly.

ENTOMOLOGY.[1]

Dimorphism in Cynipidæ.—The first record in this country, if not elsewhere, of the actual proof of dimorphism in the Cynipidæ, was by the editor of this department, in the American Naturalist for 1873 (Vol. vii, p. 519), where the common wooly oak gall which produces in spring the bisexual *Cynips q-operator*, was shown to have a larger asexual dimorphic form (our *C. q-operatola)* that develops in an autumnal pip-like gall formed between the cupule and the fruit. Walsh had previously given good reasons for the belief that *C. q-aciculata* was the autumnal agamic dimorphous form of *C. q-spongifica (Am. Entomologist* ii, p. 330, ff.), and Mr. H. F. Basset has, following Adler's interesting experiments in Europe, suggested the probable dimorphic connection of several of our vernal galls which produce bisexual individuals with autumnal forms which produce larger, asexual flies. Dr. Adler continues his successful study and experiment in this direction, and gives in the *Zeitschrift für wissens. Zool.* (Vol. xxxv, p. 151), the results obtained so far in his researches, and the number of species in which the occurrence of dimorphic forms has been proven is already quite considerable. The following is a list thereof, the name in the first column referring to the agamic, that in the second to the bisexual generation:

1.	*Neuroterus lenticularis*	=	*Spathegaster baccarum*
2.	" *læviusculus*	=	" *albipes*
3.	" *numismatis*	=	" *vesicatrix*
4.	" *fumipennis*	=	" *tricolor*
5.	*Aphilotrix radicis*	=	*Andricus noduli*
6.	" *sieboldi*	=	" *testaceipes*
7.	" *corticis*	=	" *gemmatus*
8.	" *globuli*	=	" *inflator*
9.	" *collaris*	=	" *curvator*
10.	" *fecundatrix*	=	" *pilosus*
11.	" *callidoma*	=	" *cirratus*
12.	" *malpighii*	=	" *nudus*
13.	" *autumnalis*	=	" *ramuli*
14.	*Dryophanta scutellaris*	=	*Spathegaster taschenbergii*
15.	" *longiventris*	=	" *similis*
16.	" *divisa*	=	" *verrucosus*
17.	*Biorhiza aptera*	=	*Teras terminalis*
18.	" *renum*	=	*Trigonaspis crustalis*
19.	*Neuroterus ostreus*	=	*Spathegaster aprilinus ?*

Of Nos. 1–13, the first form appears in March until May, the second in June until July, or in some species in August. In Nos. 15–19 the agamic generation appears from October until March, and the sexual generation in May until July. In No. 14 the first form appears in January until February, the second in May until June.

Very remarkable is the fact that in some closely allied species no alternate generation seem to occur. They are the following species: *Aphilotrix seminationis, marginalis, quadrilineatus* and *albopunctatus*.

[1] This department is edited by Prof. C. V. Riley, Washington, D. C., to whom communications, books for notice, etc., should be sent.

BLEPHAROCERIDÆ.—The very interesting discovery, by Dr. Fritz Müller, of the earlier states of *Paltostoma torrentium*, has been followed in rapid succession by that of other Blepharocerid larvæ and pupæ in various parts of the globe, and it seems that most, if not all, species of Blepharoceridæ agree in the mode of development and in habit. Thus Dr. F. Brauer finds that pupæ from the mountain streams at Meran, Tirol, are closely allied to those of *Paltostoma torrentium*, and that they are, in all probability, those of *Blepharocera fasciata*. We have for some time had in our collection a number of pupæ which were found six or seven years ago in the month of June by Mr. H. G. Hubbard near Fitchburg, Mass., and which we at once recognized as of some species of Blepharocera, upon seeing a photograph of the figures by Fritz Müller in Dr. Hagen's possession. The pupæ occurred in a mountain stream on a flat rock over which ran swiftly a thin sheet of water. The surface of the rock was coated with the pupæ. Another species (*Liponeura brevirostris* Löw) has been described in the larva and pupa states by H. Dewitz in the Berlin *Entomologische Zeitschrift* (Vol. XXV, p. 61–66). The latest contribution to the natural history of these interesting Diptera we owe to Dr. A. Wierzejski of the University of Krakau, who gives in the *Zoologischer Anzeiger* (No. 81, p. 212–216) full descriptions of the larva and pupa of another Blepharocerid. He found them in a mountain brook in the Tatra mountains, adhering to the rocks in the swiftest part of the current. The larvæ are able, by means of the six suctorial disks on the ventral side not only to withstand the swift current but also to move freely about, usually sidewise. Dr. W. did not succeed in rearing the perfect insect, as the larvæ and pupæ soon perished when confined in standing water; but from examination of the pupæ he is confident that his species is very nearly allied to *Blepharocera fasciata*. He promises further investigation of the subject, and especially on that most interesting discovery made by Dr. Fritz Müller, viz: the occurrence of dimorphic females in the species of Itajahi, the two forms of the female widely differing from each other in the organs of the mouth, the size of the eyes and the structure of the last tarsal joint. Dr. Müller's full paper on the metamorphosis of *Paltostoma torrentium* and the anatomy of its larva will be shortly published in the "Archivos do Museu Nacional do Rio de Janeiro."

For those not familiar with the descriptions already given of the larvæ and pupæ of this interesting group of Diptera we would add that the larva is one of the most remarkable in the insect world. It has apparently but six joints to the body, and its general appearance recalls that of *Asellus*, the joints being, however, deeply cut on the sides and widely separated. The six-jointed character is, however, only apparent, as the last joint is evidently composed of three, and the first joint is also evidently composed of several, the head being distinctly separated beneath. The sides of the joints appear tuberculous and each joint has, indeed, a pair of separate, decurved, cylindrical and pointed tubercles issuing from it, resembling six pairs of legs, and used doubtless to lift the larva from its attachment when movement is desired. Medio-ventrally there is a series of six circular, elevated sucking disks, each having a series of tracheal filaments on the side, which filaments also doubtless aid in suction. The pupa is very flat ventrally, convex dorsally, with two conical horns on the anterior end, each composed of four compressed laminæ, which easily separate, and which are the thoracic tracheæ, corresponding to those of other aquatic dipterous pupæ, as in the common mosquito. The pupæ collected in Massachusetts are somewhat smaller than Fritz Müller's specimens, but structurally identical. They strongly recall in color and general appearance some of our smaller Gyrinid beetles.

BRAULA CŒCA NOT PARTICULARLY INJURIOUS TO THE HONEY BEE.—Mr. J. Fedarb has in Hardwicke's *Science Gossip* for May 2, 1881, an article on *Braula cœca*, that curious dipterous parasite of our honey bee. He asserts that there can be no doubt that the damage done by it is generally overestimated, and that the ravages of other hidden guests within the apiary are often wrongly attributed to Braula, the real authors of the mischief being overlooked. Braula is no doubt annoying to the bee it infests, but only when it occurs in very great numbers has it an injurious effect on the bee colony. Mr. Fedarb finds that Braula was unknown to the ancient authors on the honey bee, while even such careful observers of a more recent time as Swammerdam and Huber do not mention it at all. The parasite may have only lately developed the habit of living on the honey bee, being present formerly under other conditions, or it may have spread recently from some restricted point of the globe.

ECONOMIC ENTOMOLOGY IN ENGLAND.—Miss L. A. Ormerod's "Notes of Observations of Injurious Insects" for the year 1880 has been kindly sent us by the authoress. Of the numerous instances of insect injury during that year in Great Britain, none is more remarkable than that of the wide-spread damage caused by various species of Tipulid larvæ to wheat, barley, oats, cabbage, potatoes, peas and strawberries. The larvæ gnaw away the outer part of the plant just at the surface of the ground or a little beneath it, thus weakening or in many instances killing the plants. Tipulid larvæ are very plentiful in many parts of our own country, and occasionally inflict some damage to rich meadows, but no case of injury to field and garden crops has so far been reported to us. Miss Ormerod is doing an admirable work, and we are glad to see that she is meeting with success and encouragement.

THE CULTIVATION OF PYRETHRUM AND MANUFACTURE OF THE POWDER.—In accordance with an announcement in the March number of the NATURALIST, the editor of this department has sent out the seed of two species of Pyrethrum, viz: *P. roseum* and *P. cinerariæfolium*, to a large number of correspondents in different parts of North America. Every mail brings us some inquiries for further particulars and directions to guide in the cultivation of the plant and preparation of the powder. We have concluded, therefore, that such information as is obtainable on these heads will prove of public interest, and we shall ask Professor Bessey's pardon for trenching somewhat on his domain.

There are very few data at hand concerning the discovery of the insecticide properties of Pyrethrum. The powder has been in use for many years in Asiatic countries south of the Caucasus mountains. It was sold at a high price by the inhabitants, who successfully kept its nature a secret until the beginning of this century, when an Armenian merchant, Mr. Jumtikoff, learned that the powder was obtained from the dried and pulverized flower-heads of certain species of Pyrethrum growing abundantly in the mountain region of what is now known as the Russian province of Transcaucasia. The son of Mr. Jumtikoff began the manufacture of the article on a large scale in 1828, after which year the Pyrethrum industry steadily grew, until to-day the export of the dried flower-heads represents an important item in the revenue of those countries.

Still less seems to be known of the discovery and history of the Dalmatian species of Pyrethrum (*P. cinerariæfolium*), but it is probable that its history is very similar to that of the Asiatic species. At the present time the Pyrethrum flowers are considered by far the most valuable product of the soil of Dalmatia.

There is also very little information published regarding either the mode of growth or the cultivation of Pyrethrum plants in their native home. As to the Caucasian species we have reasons to believe that they are not cultivated, at least not at the present time, statements to the contrary notwithstanding.[1] The well-known Dr. Gustav Radde, director of the Imperial Museum of Natural History at Tiflis, Transcaucasia, who is the highest living authority on everything pertaining to the natural history of that region, wrote us recently as follows: "The only species of its genus, *Pyrethrum roseum*, which gives a good, effective insect powder, is nowhere cultivated, but grows wild in the basal-alpine zone of our mountains at an altitude of from 6000 to 8000 feet." From this it appears that this species, at least, is not cultivated in its native home, and Dr. Radde's statement is corroborated by a communication of Mr. S. M. Hutton, Vice-Consul General of the U. S. at Moscow, Russia, to whom we applied for seed of this species. He writes that his agents were not able to get more than about half a pound

[1] Report Comm. of Patents, 1857, Agriculture, p. 130.

of the seed from any one person. From this statement it may be inferred that the seeds have to be gathered from the wild and not from the cultivated plants.

As to the Dalmatian plant it is also said to be cultivated in its native home, but we can get no definite information on this score, owing to the fact that the inhabitants are very unwilling to give any information regarding a plant the product of which they wish to monopolize. For similar reasons we have found great difficulty in obtaining even small quantities of the seed of *P. cinerariæfolium* that was not baked or in other ways tampered with to prevent germination. Indeed, the people are so jealous of their plant that to send the seed out of the country becomes a serious matter, in which life is risked. The seed of *Pyrethrum roseum* is obtained with less difficulty, at least in small quantities, and it has even become an article of commerce, several nurserymen here, as well as in Europe, advertising it in their catalogues. The species has been successfully grown as a garden plant for its pale rose or bright pink flower-rays. Mr. Thomas Meehan, of Germantown, Pa., writes us: "I have had a plant of *Pyrethrum roseum* in my herbaceous garden for many years past, and it holds its own without any care much better than many other things. I should say from this experience that it was a plant which will very easily accommodate itself to culture anywhere in the United States." Peter Henderson, of New York, another well-known and experienced nurseryman, writes: "I have grown the plant and its varieties for ten years. It is of the easiest cultivation, either by seeds or divisions. It now ramifies into a great variety of all shades, from white to deep crimson, double and single, perfectly hardy here, and I think likely to be nearly everywhere on this continent." Dr. James C. Neal, of Archer, Fla., has also successfully grown *P. roseum* and many varieties thereof, and other correspondents report similar favorable experience. None of them have found a special mode of cultivation necessary. In 1856 Mr. C. Willemot made a serious attempt to introduce and cultivate the plant[1] on a large scale in France. As his account of the cultivation of Pyrethrum is the best we know of we quote here his experience in full, with but few slight omissions: "The soil best adapted to its culture should be composed of a pure ground, somewhat siliceous and dry. Moisture and the presence of clay is injurious, the plant being extremely sensitive to an excess of water, and would in such case immediately perish. A southern exposure is the most favorable. The best time for putting the seeds in the ground is from March to April. It can be done even in the month of February if the weather will permit it. After the soil has been prepared and the

[1] Mr. Willemot calls his plant *Pyrèthre du caucase* (*P. Willemoti* Duchartre), but it is more than probable that this is only a synonym of *P. roseum*. We have drawn liberally from Mr. Willemot's paper on the subject, a translation of which may be found in the Report of the Commissioner of Patents for the year 1861, Agriculture, pp. 223–331.

seeds are sown they are covered by a stratum of ground mixed with some vegetable mould, when the roller is slightly applied to it. Every five or six days the watering is to be renewed, in order to facilitate the germination. At the end of about thirty or forty days the young plants make their appearance, and as soon as they have gained strength enough they are transplanted at a distance of about six inches from each other. Three months after this operation they are transplanted again at a distance of from fourteen to twenty inches, according to their strength. Each transplantation requires, of course, a new watering, which, however, should only be moderately applied. The blossoming of the Pyrethrum commences the second year, toward the end of May, and continues to the end of September." Mr. Willemot also states that the plant is very little sensitive to cold, and needs no shelter, even during severe winters.

The above-quoted directions have reference to the climate of France, and as the cultivation of the plant in many parts of North America is yet an experiment, a great deal of independent judgment must be used. The plants should be treated in the same manner as the ordinary Asters of the garden or other perennial Compositæ.

As to the Dalmatian plant, it is well known that Mr. G. N. Milco, a native of Dalmatia, has of late years successfully cultivated *Pyrethrum cinerariæfolium* near Stockton, Cal., and the powder from the California-grown plants to which Mr. Milco has given the name of "Buhach" retains all the insecticide qualities and is far superior to most of the imported powder as we know from experience. Mr. Milco gives the following advice about planting—advice which applies more particularly to the Pacific coast: "Prepare a small bed of fine, loose, sandy, loamy soil, slightly mixed with fine manure. Mix the seed with dry sand and sow carefully on top of the bed. Then with a common rake disturb the surface of the ground half an inch in depth. Sprinkle the bed every evening until sprouted; too much water will cause injury. After it is well sprouted, watering twice a week is sufficient. When about a month old, weed carefully. They should be transplanted to loamy soil during the rainy season of winter or spring."

Our own experience with *P. roseum* as well as *P. cinerariæfolium* in Washington, D. C., has been so far quite satisfactory. Some that we planted last year in the fall came up quite well in the spring and will perhaps bloom the present year. The plants from sound seed which we planted this spring are also doing finely, and as the soil is a rather stiff clay and the rains have been many and heavy, we conclude that Mr. Willemot has overstated the delicacy of the plants.

In regard to manufacturing the powder, the flower heads should be gathered during fine weather when they are about to open, or at the time when fertilization takes place, as the essential oil that gives the insecticide qualities reaches, at this time, its greatest development. When the blossoming has ceased the stalks may be cut within about four inches from the ground and utilized, being ground and mixed with the flowers in the proportion of one third of their weight. Great care must be taken not to expose the flowers to moisture, or the rays of the sun, or still less to artificial heat. They should be dried under cover and hermetically closed up in sacs or other vessels to prevent untimely pulverization. The finer the flower-heads are pulverized the more effectually the powder acts and the more economical is its use. Proper pulverization in large quantities is best done by those who make a business of it and have special mill facilities. Lehn & Fink, of New York, have furnished us with the most satisfactory powder. For his own use the farmer can pulverize smaller quantities by the simple method of pounding the flowers in a mortar. It is necessary that the mortar be closed, and a piece of leather through which the pestle moves, such as is generally used in pulverizing pharmaceutic substances in a laboratory, will answer. The quantity to be pulverized should not exceed one pound at a time, thus avoiding too high a degree of heat, which would be injurious to the quality of the powder. The pulverization being deemed sufficient, the substance is sifted through a silk sieve, and then the remainder, with a new addition of flowers, is put in the mortar and pulverized again.

The best vessels for keeping the powder are fruit jars with patent covers or any other perfectly tight glass vessel or tin box.

In the next number we will give some account of the different ways in which the powder may be used to destroy insects.

TREES ATTRACTIVE TO BUTTERFLIES.—Mrs. A. E. Bush, of San José, Cal., writes: "I have been to Monterey, and was fortunate enough to see the 'butterfly tree,' or trees, as there are three of them. These trees are the Monterey pine (*Pinus insignis* Dougl.), and are probably over one and a half feet in diameter, and completely covered with live butterflies. To say that there were as many butterflies as leaves upon the trees would not be a very great exaggeration. I saw them in the morning when it was cool and they could not fly very well, and picked up a dozen from the grass in a few seconds. A lady resident informed me that for the twelve years she had lived there the appearance had been the same."

HUDSON BAY LEPIDOPTERA.—Mr. J. Jenner Weir, in the May number of the *Entomologist* (London, England), has an article on the Lepidoptera Rhopalocera of Hudson's bay, drawn from specimens obtained in two years' collecting in that dreary region by Mr. Walton Haydon. There are seventeen species of butterflies belonging to ten genera, all the genera but one occurring in Great Britain. The list includes *Vanessa antiopa*, *Pyrameis car-*

dui, *P. atalanta*, *Pieris oleracea*, *Argynnis atlantis*, *A. myrina*, *Vanessa milberti*, *Grapta faunus*, *Lycæna lucia*, *Colias eryth e me*, var., *keewaydin*, *Argynnis lapponica*, *A. tarquinius*, *A. bellona*, *Papilio glaucus* var. *turnus*, *Limenitis arthemis* var. *lamina*, and *Phyciodes tharos*. Mr. Weir concludes his paper with the following remarks: "The collection of which I have now given a description, small as it is, is not wanting in interest. It is surprising to contemplate the time which must have elapsed since the three identical with European species had a common ancestor, and yet the difference now existing is too slight to consider them even varieties of each other. A former connection with Europe by the Faröe islands, Iceland and Greenland no doubt existed, and during one of the periods of mild Arctic climate the transmission of species from one continent to another was effected. We are so in the habit of calling this hemisphere the old world, that it does not occur to us that it is just as likely that *Vanessa antiopa* passed from America to Europe, as that the converse was the case."

Unfortunately the three species referred to (*Vanessa antiopa*, *Pyrameis cardui* and *P. atalanta*) are the very poorest that could be chosen as indicating length of time required for variation of forms that have become separated by wide expanse of ocean. They are cosmopolitan butterflies, all known to be capable of extended flight, and it seems to us that the constancy they exhibit in different quarters of the globe is explicable rather on frequent and recent migration from one part of the world to another.

Trade in Insects.—It is a well known fact that sixty or more years ago exorbitant prices were paid for rare insects, or at least for species that were considered rare. Since that time the market price for insects has been constantly on the decline, and at the present time a vast number of species of the two favorite orders, Lepidoptera and Coleoptera, can be had through reliable dealers at very reasonable prices, and generally correctly determined. Still there are some exceptions to this rule, and a recent auction sale in London of the collection of the late J. Aspinwall Turner, M.P., shows that the price commanded by the gorgeous species of the Goliath beetles is scarcely inferior to that paid by collectors in the days of Drury and Donovan. The following are some of the prices obtained at that auction sale: lot 61, 2 *Euchirus dupontianus*, 2 *E. macleayi*, 3 *E. cantori* and 3 *E. hardwickii* brought £8; lot 91, 2 *Goliathus giganteus* £7; lot 92, 1 *Goliathus giganteus*, 1 *G. kirkii* and 1 var.? *G. cacicus* ♀ £20; 1 *Ischnoscelis dohrni* £10; one pair of *Goliathus fornassinii* £24. It might be mentioned in this connection that at the beginning of this century Donovan paid for 1 *Goliathus giganteus* the handsome sum of 12½ guineas.

Ants Injurious in Arizona.—Mr. H. H. Rusby, of Clifton, Arizona, sends us a rather doleful account of the destruction wrought by ants in that Territory. He says the country is one vast ant colony, and that the ants prove the greatest drawback to successful agriculture in the more arable portions. Several species seem to be thus troublesome, and until they are better known and the habits of the different species studied, it will be impossible to suggest a rational mode of warfare against them.

Larvæ of Coleoptera.—Professor F. G. Schaupp continues, in the Bulletin of the Brooklyn Entomological Society, his descriptions of larvæ of Coleoptera. In No. 10, Vol. III, of said Bulletin, he gives a plate with illustrations representing the larvæ of *Platynus extensicollis*, *Chlænius leucoscelis*, *Pterostichus lucublandus*, *P. mutus* and *Staphylinus vulpinus*.

Covering of Egg-puncture mistaken for Dorthesia.—In hastily looking over the collection of the late Dr. Fitch recently, we were somewhat amused to recognize the white and ribbed waxy material covering the egg-punctures of *Enchophyllum binotatum* labeled as *Dorthesia viburni* and *D. celastri*. This covering does bear a superficial resemblance to the exudations of Dorthesia, though a glance suffices to show that it has no structure connected with it. We cannot find that any such species of Dorthesia were described by Fitch, though Glover refers to his *D. celastri* as found on Celastrus (Agricultural Report, 1876, p. 45). Mr. Lintner, the present State entomologist of New York, thinks that the species may possibly have been published in fugitive articles in the *Country Gentleman*, but we have no means of ascertaining the facts.

Mr. H. Keenan, of Quaker City, Ohio, sends us the saw-fly, *Dolerus unicolor* (Beauv.), the ♀ of which is described as *arvensis* by Say, with a statement of its injuries to the fruit buds of pear trees by eating holes therein, the saw-flies occurring in vast numbers around the trees. This is the first case that has come to our knowledge of a Tenthredinid in the imago state injuring vegetation, and it is possible that some other insect may have been the real depredator.

Supposed Army Worm in New York and other Eastern States.—Numerous accounts have been published in the daily and weekly journals of the East, announcing wide-spread injury by the "army worm." This injury has occurred in New Jersey, on Long Island and in most of the grazing sections of New York, especially in St. Lawrence, Franklin, Jefferson, Oswego and Hamilton counties. Professor J. A. Lintner, State Entomologist of New York, has published the fullest account of its ravages in the Albany papers, which have been quoted in the *Country Gentleman*. Mr. J. Q. Adams, of Watertown, N. Y., writes to us under date of May 24th, as follows:

"Many hill pastures hereabouts are being ruined by what is called the army worm and while I cannot doubt but that it is *Leucania unipuncta* from its work, still I wish confirmation of the fact by an authority. My search in the fields has developed only a black headed, black spotted, smoky colored, naked worm that builds a nidus of its own chips, which are pure green, and lives either close upon or below the surface of the soil. I know what the mature army worm is like from my books, but I find no mention of the immature larvæ. If you will favor me with a line or pamphlet describing the immature worm, you will help me out of the dilemma. Doubts suggest themselves because of the silken nidus which seems to me inconsistent with migratory habits.

The work of the pests, which I suppose has been checked the past week by the heavy rains we have had, is already considerable, some fields as large as forty acres being ruined and others showing only dead spots of a rod or two square. It is confined to the limestone ridges and to pastures. Are all our other pastures in danger? This is a dairy country and great harm will result if the work continues."

There seems to have been considerable doubt as to whether these worms were the true army worm or not. From specimens that were forwarded to us by Mr. Lintner and Mr. Adams, it would seem that there are two different species concerned in the work. The principal and larger one is the larva of *Nephelodes violans* Guen. We have known the insect since 1871, and it is tolerably common all over the eastern portion of the country. Walsh refers to it in an unpublished note as being found in meadows under stones at Rock Island, Ill. We have found it on a number of occasions since 1871 in different parts of Illinois and Missouri, usually hiding under planks or stones or cow dung in meadows, but occasionally feeding some distance up on a grass stalk, even in the hot sun. When at rest it is usually curled sidewise and surrounded with its frass which is of a bright green color. The larva is one of our largest cut-worms, distinguished from all others by the pale amber-colored head and the bronzy hue of the body; the pale dorsal and sub-dorsal stripes always showing distinctly on the dark, highly polished cervical and anal plates. It is referred to by Mr. G. H. French, of Carbondale, Ill., in the *Prairie Farmer* for April, 1878, and also in Professor Thomas's 2d Report on the Insects of Illinois (7th State Report, for 1877), pp. 99 and 220. We have also referred to it as taken from the stomach of a blue-bird, in the *American Entomologist* Vol. III, p. 205. The larva is found of various sizes in the early spring, some being so large as to prove hibernation in this state, larval hibernation being further established by the occurrence of the specimen in the stomach of a blue bird shot in March, and by our having dug it up in a semi-torpid state last February in Virginia. The species may also hibernate, however, in the imago state, in which it is frequently captured in the winter, especially in the Southern States. The very young larvæ are bright-green with indications of the stripes which characterize the full-grown larva. The eggs have not yet been discovered. Pupation takes place in a naked cell just beneath the surface, and not till June or thereafter even in Missouri, the moth issuing in the autumn.

The wide-spread appearance and injury of the species the present spring, furnishes an excellent illustration of the fact, that species which have never before been looked upon as injurious to agriculture may suddenly become so. The insect has various parasites.

We notice that Mr. Lintner, disregarding the popular name of "bronzy cut-worm," by which we have characterized the larva, proposes to call it the "grass-cutter," on the plea that the term "worm" is, strictly speaking, used for the class Vermes, and should be discarded from entomological nomenclature as applying to larvæ. Such ultra-refined reasoning, could it have any following, would lead to absurd ends. Vulgar names rarely become popular except as they come from the people, and should, when coined by naturalists, be as far as possible specific of some peculiarity that will permit recognition of the object. The term "grass-cutter" is a general one that would equally fit the army worm, the Pyralid larva referred to by Mr. Adams, and dozens of other Noctuid larvæ which are "grass-cutters" and to which the term "cut-worm" has been aptly applied. The term "worm," in the entomological sense, comes from the people and is universally employed by English writers, while its equivalent is employed in the same sense in French, German and other languages. To undertake to eliminate it from the vernacular is to attempt an innovation which will meet with deserved failure, and the impossibility of doing which Mr. Lintner concedes in his necessary use of the terms "army worm," "apple worm," "cabbage worm," etc.

The second worm is a much smaller larva of a dingy color, with large piliferous spots, and evidently belonging to the Pyralidæ. We have also in past years found it in Missouri in pastures, mostly under cow dung, but have not yet reared it to the imago state. It evidently played a considerable part in the injury referred to by Mr. Lintner, and was more common than the Nephelodes in the fields referred to by Mr. Adams. It forms, for transformation, among the grass roots, an elongate pod of silk intermixed and covered on the outside with earth.

Without having seen the specimens it would have been safe to conclude that the reported injury was not from the true army worm, which nevers appears, in destructive numbers, so early in the season in the northern part of New York, and Professor Lintner was rightly led by this reasoning to doubt whether it was that species. So far as we can learn, the Nephelodes larvæ have shown no propensity to travel from field to field as does the true army worm. They will soon disappear, from death or through transformation, and are not likely to attract any further attention the present season. Most of the remedies recommended for the army worm will apply to the Nephelodes larva, a full description of which we append from our notes, in order that it may be distinguished from the *Leucania unipunctata*, the larval changes of which are described in our 8th Mo. Report, pp. 184–5.

NEPHELODES VIOLANS—*Larva:* Larger specimens fully 1.9 inch long, largest in middle of body and tapering slightly each way, especially toward anus. Color brownish bronze, the surface faintly corrugulate but polished, the piliferous spots obsolete. A darker, highly polished cervical shield and anal plate. A medio-dorsal and sub-dorsal stripe of a buff, or dull flesh color, each stripe of about equal diameter, (nearly 0.04 inch on middle joints) forming narrower, paler lines on the plates and nearly converging on the anal plate; a similar but somewhat broader substigmatal stripe which is wavy below; between sub-dorsal and stigmatal stripes a faintly indicated pale line dividing the space nearly equally. Venter nearly of same buff color, with a tinge of green. *Head* perpendicular, immaculate, paler than body, rugulose, sub-polished, faintly translucent, pale dingy-olive, the jaws, and sometimes the mouth-parts, darker. Legs and prolegs of same pale olive color, the latter with a black band at outer base. Stigmata black.

The young larva is green but early shows the pale stripes. When about one third grown the general hue is olive-green with the cervical and anal plates but little darker. The head is pale, greenish, faintly freckled and with a few dark hairs; the sutures pale, the mandibles tinged with blood-r d and brown at extremeties, and the ocelli distinct on a pale ground, the second and third from below, black, the others light. The three dorsal stripes and the narrower supra-stigmal line are very pale, greenish-yellow, the broader sub-stigmatal stripe of a clearer cream-yellow with a faint carneous tint.

One of the most marked Noctuid larvæ, at once distinguished from all others known to me when full grown by the pale, immaculate head (recalling copal) and the polished, bronzy or umber color of body. The upper stripes are often obsolete or subobsolete in the middle of body, but are persistent on the plates. The bronzy color in paler specimens is due to brown and yellow mottlings, and in dark specimens becomes nearly black; while the stripes are generally minutely mottled with carneous.

Pupa—Normal, dark brown, the tip with two horizontal almost parallel spines.

MIGRATION OF BUTTERFLIES.—Under date of June 2, Dr. J. H. Mellichamp, of Bluffton, S. C., sends the following interesting account of the migration of a butterfly, the species being *Pieris monuste* L., a tolerably common insect in the South. The larva, according to authors, feeds on *Cleome pentaphylla*, and Mr. E. A. Schwarz found it in Texas on *Polanisia trachysperma*. It is colored with faint violet and with citron-yellow stripe, the head, legs and venter being greenish-yellow, both head and body being spotted with black piliferous tubercles, the larger ones in four rows. The chrysalis is pale yellowish, spotted and shaded with brown, and characterized by two black filamentous spines on the middle of the body (fourth abdominal joint). Dr. M. says:

"I enclose specimens of a white butterfly, thousands of which have been steadily passing over this place from west to east (apparently against the wind) both yesterday and to-day. Savannah (Ga.) is west or south west of this place, and I am informed that oats had been destroyed there some two or three weeks ago by a caterpillar. Can this stranger be the parent of the same? Being white, they can be seen at a long distance, and they come along in twos, and threes, and fours and sometimes in a greater number—going steadily east or north-east—seldom stopping ("so hasty" as a darkey would say!), but occasionally alighting on a weed, or shrub, or flower (Gardenia).

Usually they fly at the distance of fifteen or twenty feet from the earth. Most are white, and larger, I think, than the enclosed; a few are darker, like this other specimen. They are shy and wary and very difficult to capture. A colored man said to me that they came in his field "like a swarm of bees," and that he "just couldn't stand it any longer—never saw such a thing in my life,"—and so dropped his hoe and came home!!

CLASSIFICATION OF THE MITES.—In a recent letter Dr. G. Haller, of Bern, Switzerland, already well known through his studies of the Acarina, informs us that, after a great number of examinations, he finds that these curious creatures have not only three pairs of maxillæ and a true labium with palpi, but, as is already known, two pairs of abdominal, as well as cephalothoracic, legs. He does not consider that they belong to the Arachnida, with which they have been hitherto placed, but that they are much more nearly allied to the Crustacea, from which they differ, of course, in breathing through tracheæ instead of gills. He believes they must form a fifth class of Arthropods equivalent to Crustacea, Myriapoda, Arachnida and Hexapoda.

Carrying out the Law.—The British Parliament passed, in 1877, an act providing for the imposition of a fine for the person who should import living specimens of the Colorado potato-beetle. That this act did not remain an empty letter is proven by the following case: In February of this year it came to the knowledge of the authorities that a man in Devonshire had in his possession living specimens of the Doryphora, which he had brought over from America, and which he refused to give up. The man was immediately tried, convicted and fined £5, notwithstanding he proved that he had meanwhile killed the beetles. The Devonshire farmers are said to be much dissatisfied at the small amount of the fine, the maximum penalty fixed by law being £10.

Locusts in Mexico in 1880.—We are indebted to Dr. E. Palmer, for the following data concerning the appearances of locusts of unknown species in Mexico last autumn. They appeared during October at Chihuahua, at Saltillo and at Parras. At Saltillo they attacked the winter wheat, which was sufficiently advanced to be injured by them.—*A. S. Packard, Jr.*

Erratum.—A rather annoying error crept into the article on Cicada in the last number. On page 481, line fourteen, from bottom, "1860" should be "1660," that being the year of the last simultaneous appearance of the two broods that appear this year.

ANTHROPOLOGY.[1]

Archæological Researches in Nicaragua.—Number 383 of the Smithsonian Contributions is an important addition to our knowledge of Ancient America, entitled "Archæological Researches in Nicaragua," By J. F. Bransford, M. D., Passed Assistant Surgeon, U. S. Navy. Washington City: Published by the Smithsonian Institution, 1881." Dr Bransford made three journeys to Nicaragua, one in 1872, with Commander E. P. Lull, a second in 1876, when several months were spent in archæological explorations, and a third in 1877, at which time the author's investigations were extended to Nicoya, in Costa Rica. Excepting the last named excursions, all the excavations were made on the Island of Ometepec, and to a slight extent near San Jorge on the mainland.

The geology and natural scenery of the island, the lake, and the surrounding country, are so graphically described that the

[1] **Edited by Prof. Otis T. Mason, Columbian College, Washington, D. C.**

reader will have no trouble in following the narrative and in catching the relation between the sites explored and their environment. The hacienda of Don José Angel Luna having been placed at the author's disposal in 1876, most of the work was done in that vicinity. To reach the burial vessels it was necessary to dig down through a layer of light ash and volcanic cinder, a second of old lava much decomposed, a third of gritty ash, to the fourth, of black sand similar to that now forming the neighboring beach. Pottery, beads, shells, human bones, etc., the necessary concomitants of such a site, were found in abundance. The great interest of the exploration, however, and the *raison d'être* of the book are the burials jars, some globose, others with wide flaring mouths, but the greater number belonging to the unique shoe-shaped burial urns of coarse red material, over the mouth of which were placed delicate bowls of thin yellow ware elaborately painted.

To the description of the covers which are called Luna ware, especially to the elucidation of the designs upon the exterior and the interior surface, Dr. Bransford gives the greatest attention. It is very much to be regretted that his artist is so far behind him; indeed, in a few instances, has omitted from the drawing the very features alluded to in the text. It is a grave fault of nearly all who attempt to illustrate savage technique that things are represented more regular and beautiful than they really are. In this instance, however, the picture falls very far beneath the reality. The two plates of photolithographs at the end are worse still, the objects seeming to be blurred and out of focus.

On page 15-19 will be found a detailed list of the burial urns, giving their shape, the width and depth of both jar and cap, and the position and the contents of each. The author, after reviewing what has been said concerning the origin of the shape of these unique objects, inclines strongly to the view that they are rude representations of birds. Stone graves similar to those of Tennessee, and mounds also, occur in the locality examined. Stone images already made familiar to us by Stephens and Squier, and rock carvings form the closing pages of the chapters devoted to Ometepec. Chapter III relates to Palmar, on the mainland, in the department of Rivas, north-west of San Jorge; Managua; San Juan del Sur; and a pottery manufactory near San Jorge. Chapter IV gives a description of Nicoya and an enumeration of objects in greenstone. The concluding chapter is devoted to the historical relations of the tribes formerly inhabiting the region, beginning with the Aztec tribes of the conquest and working back to the people of the shoe-shaped burial jars, "more closely connected with the South Americans than with Nahuas and Mayas of Mexico and Guatemala."

The volume closes with a minute list of Dr. Bransford's collection, giving over 1500 entries.

WILD RICE IN EUROPE.—The *Zizania aquatica*, or wild rice, grows very extensively in many parts of the United States, and being a wholesome food-plant, has been, and is still one of the most important food articles of the Indians of the Mississippi plains. The Menomonees are named after it and were formerly called by the French "Folles Avoines."

Many fruitless attempts have been made to introduce this plant into Europe; but the seeds had arrived in a too desiccated condition. Lately M. Villmorin sent fresh grains over to France packed in a box filled with wet moss, and the recipient Count Hyacinthe de Charencey, at St. Maurice les Charencey, Department of the Orne, placing them in a morass, or swamp, had the satisfaction of seeing them sprouting. They soon arrived at maturity, and thus the beginning is made of transplanting this important food-plant into a climate which may prove just as congenial to it as that of the American swamps, where we see it growing in such great profusion.—*Albert S. Gatschet.*

NORSE MYTHOLOGY.—The traveler in Switzerland passing from one village to another finds himself ever and anon at the foot of a glacier, where he beholds in the weird cathedral outlines the crystallized remains of the soft and plastic snow,—in its high mountain origin so homogeneous and so circumscribed, in its terminations so widely separated and so strongly individualized. The same is true of the world's mythologies, all having their origin in the sensitive spirit of man as it ponders over and reaches after the unseen cause of all phenomena, but transformed into distinct systems through the laws of nature and the influence of circumstance. The comparison of these various resultant forms constitutes one of the most valuable chapters in anthropology. It is impossible to attempt a scientific classification, much less to make reliable deductions, until all the descriptions are in. We are indebted to S. C. Griggs & Co., of Chicago, for the third edition of a volume upon Norse mythology, by Prof. R. B. Anderson. The introductory portion of the work, though written in a style of glowing enthusiasm, does not please us so much as parts I, II and III, relating to the creation and preservation of the world, the life and exploits of the gods, and Ragnarak, or destruction and regeneration. The three sections are dedicated to Urd (was), Verdando (is), Skuld (shall be).

The chief depositories of the Norse mythology are the Elder or Saemund Edda (poetry) and the Younger or Snorre's Edda (prose). The former consists of thirty nine poems collected by Saemund the Wise (1056–1133), eleven of which, embodying the system of mythology, are minutely analyzed in the volume. The Younger Edda was written by Snorre Sturleson, the author of the *Heimskringla* (1178–1241). In addition to these it is necessary to study all the Icelandic Sagas, the Anglo-Saxon Boewulf's *Drapa*, and the Niebelungen Lied.

The gods and goddesses (*æsir* and *ásynja*) dwelling in Asgard are Odin (chief of the gods), Thor (god of thunder and keeper of the hammer), Balder (summer-sunlight), Tyr (Zeus, the one-armed god of war), Brage (god of poetry), Heimdal (the heavenly watchman), Hoder (the Norse Cain), Vidar (slayer of the Fenris wolf), Vale (brother of Balder), Uller, Forsete (the peacemaker), and Loke (the evil giant-god). The goddesses are twenty-six in number. Odin's hall is the great Valhal. The tree Ygdrasil, striking its roots through all worlds, spreading its life-giving arms through the heavens, and furnishing bodies for mankind from its branches is beautifully described (188, and 205). The second part of the volume, 215–409, constitutes a perfect classical dictionary of Norse mythology, adding to its richness of detail the enthusiasm of intense sympathy.

The final destruction of the world, and regeneration of gods and men, is called Ragnarak. This theoktonic myth is wanting in Greek mythology. Ragnarak is an outbreak of all the chaotic powers, a conflict between them and the established order of creation.

The student of comparative mythology, upon taking a work of this class in his hand, almost instinctively asks what the author will do with his body of myths. It is possible to run any theory to extremes and to say some very silly things, as Tylor and Baring Gould have shown us. Here is the point where the sympathetic reader trembles for his author. Professor Anderson, while taking the nature view of Norse mythology, handles the subject with extreme caution. The myth reflects nature and society, the one inextricably in communion with the other. The harsh climate of the North modified not only the Norse mythology, but also molded indefinitely the national character, and then the two acted and reacted upon each other.

Inscribed Stones.—In No. 53 of the tracts of the Western Reserve and Northern Historical Society, dated March, 1881, Col. Charles Whittlesey exposes the spuriousness of an inscribed stone from Newark, Ohio, described and figured in the Report of the Congress of Americanists, held at Nancy, France, in 1875 (Vol. II, p. 191). The communication upon the stone was presented to the Congress by Mr. Henry Harrisse, of New York, in the name of Dr. Samuel H. Barlow, of New York, and Dr. N. Roe Bradner, of Philadelphia, dated July, 1873. The characters purport to be Hebrew letters, and the inscriptions cover the four faces of a truncated pyramid. The story of the finding of the precious relic is briefly told by Col. Whittlesey, and calls to mind a remark made by Professor Dawkins to the editor of these notes during his visit to America last autumn: "Is it not too bad," said the learned cave-hunter, "that the question of veracity should be raised at the very threshold of an important investigation, to cast a cloud of doubt over all future work. And yet we are constantly troubled with it in England, nor are you quite free from it in America." The thanklessness of the task of showing up frauds should not deter those who are in a position to do the work effectively, should be no discouragement to those who hold the truth above all ephemeral theories.

American Philosophical Society.—In the Proceedings of the Am. Philos. Soc., 1880, but four papers appear bearing at all upon our theme:

Some recent discoveries of Stone Implements in Africa and Asia, by Henry Phillips, Jr.

On Dr. Valentini's Critique of Landa's Maya Alphabet, by J. P. Lesley.

On a kitchen heap at Saltville, in Southwestern Virginia, by C. Lewis.

Note on an engraved disk from Guatemala, by Mr. Dubois.

Cruise of the Corwin in Behring sea and the Arctic Ocean.—Document No. 118 of the Treasury Department, Nov. 1, 1880, is a Report of the cruise of the U. S. revenue steamer *Corwin*, commanded by Captain C. L. Hooper, U.S.R.M., in the Behring sea and the Arctic ocean. In addition to the customary duties of the Revenue Service and the search for missing whalers, Capt. Hooper gave a great deal of attention to ethnological research. The sad story is told of the starvation of several whole villages on St. Lawrence island, indeed over four hundred natives had died in this manner upon this one island in two years. The author attributes the great mortality to the improvidence caused by whisky. It seems rather heartless, but really, four hundred skeletons, or even crania, of this homogeneous group of people, would be a precious acquisition to any museum.

Chavero, Alfredo—Historias de las Indias de Nueva España y Islas de tierra firme. Por El Padre fray Diego Duran, Religioso de la Orden de Predicadores (Escritor del Siglo, xvi). Apendice. Explicacion del Códice Geroglefico de Mr. Aubin. Por Alfredo Chavero, Secretario perpetues de la Sociedad Mexicana de Geografía y Estradística. 16 plates.

The Victoria Institute.—The handsome volumes of this society have reached the fourteenth number. The following papers are valuable in our field of study: The ethnology of the Pacific, by the Rev. S. J. Whitmee, with a map showing the distribution of races and all the results of the latest discoveries; The Druids and their religion, by J. E. Howard; The evidence of the later movements of elevation and depression in the British Isles, by Professor T. Mck. Hughes; The religion and mythology of the Aryans of Northern Europe, by R. Brown.

Congress of Americanists.—The fourth meeting of the International Congress of Americanists will be held in Madrid, from Sept. 18–20, 1881, under the protection of King Alfonso xii. A neat little 16mo pamphlet of 72 pages, published by Manual G. Hernandez, of Madrid, contains full directions for those who would take part in the proceedings.

ANTHROPOLOGY OF THE EAST INDIES.—The Journal of the Royal Asiatic Society of Great Britain and Ireland was founded in 1823, and has been among the very foremost in fostering Oriental studies. In looking over Part I, Vol. XIII, new series, it is interesting to notice how the old standard periodicals are becoming infused with the latest subjects of anthropologic research. The number contains papers on the Indian Theistic Reformers, on the Kawi language and literature, on the Nirvana of the Northern Buddhists, and the Invention of the Indian alphabet.

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GEOLOGY AND PALÆONTOLOGY.

Fossils of the Iowa Loess.—The loess of Iowa is, for the major part, limited to the extreme western and south-western portions of the State. The counties of Fremont and Mills are entirely, while those of Page, Pottawattamie, Harrison, Monona and Woodbury, are partially covered by this deposit. Professor Witter has discovered it under and about the city of Muscatine, on the Mississippi river, but as the following list is the result of personal observations, it will be limited to those portions studied on the western side of the State. The species all belong to either aquatic, semi-aquatic or terrestrial genera. Of the species here listed, Professor J. E. Todd has given, in the Proceedings of the American Association for 1878, some eighteen forms; and in the Report of the Geological Survey of Missouri for 1855, Professor Swallow records forty species of land and fresh-water shells, all determined by the careful hand of F. B. Meek. One hundred and twenty-three species are enumerated by Professor Samuel Aughey in his "Sketches of the Physical Geography and Geology of Nebraska," but the great majority of them could not have been properly determined, and this with all due deference to that gentleman. No more than thirty-seven, *perhaps* forty, of all the forms he has enumerated can possibly stand. Of his list, eighteen are mentioned by generic names alone, and thirty-one are given with a question. It is not a little singular that most of the forms he names have not been found by other observers in the same field; they do not occur in the lists of either Professor Todd or Professor Swallow, and my own studies of the loess fail to bring many of them to light. The loess in the three States of Nebraska, Iowa and Missouri, where the gentleman named studied the formation, was all deposited during the same period, had the same origin, and the geographical extent of its deposition is too limited, by far, to admit of such radical differences of climate that tropical and sub-tropical forms should be found on one side of the Missouri river, but fail to appear in the same formation on the opposite side.

During occasional visits to the bluffs of loess that border the Missouri in the counties of Fremont and Mills, the following species of Mollusca have been found, some of them in fair abundance when the nature of the deposit is considered, while others are of extreme rarity: *Hyalina arborea* Say, *H. indentata* Say, *H. minuscula* Binney, *Stenotrema monodon* Rack., *Helicodiscus lineatus* Anth., *Conulus fulvus* Drap., *Strobila labyrinthica* Say, *Patula alternata* Say, *P. striatella* Anth., *Mesodon clausa* Say, *M. profunda* Say, *M. multilineata* Say, *M. thyroides* Say, *M. albolabris* Say, *Vallonia pulchella* Müll., *Macrocyclis concava* Say, *Pupa pentodon* Say, *P. armifera* Say, *Succinea obliqua* Say, *S. ovalis* Say, and perhaps one or two other species of Pupa not satisfactorily determined. This list comprises all the land shells found. The varieties belonging to the fresh-water fauna are less numerous, though they occur in perhaps greater relative abundance, *Limnæa* being the genus most numerously represented. The kinds found were *Helicina oculata* Say, *Pomatiopsis lapidaria* Say, *Limnæa humilis* Say, *L. reflexa* Say, *L. caperata* Say, *Physa heterostropha* Say, *Planorbis trivolvis* Say, *Segmentina armigera* Say, *Valvata tricarinata* Say, *Sphærium striatinum* Lam., and an occasional fragment of *Anodonta (?)*. The last has never been found in a sufficiently well preserved condition to make a sure generic classification. No remains of Unio have ever come under my notice. The nature of the sediment composing the loess, together with the habits of the genera above indicated, all of which inhabit comparatively still and shallow waters, will enable us to gain a fairly correct idea of the conditions under which the deposit was formed. These lists may do what they can to determine the origin of the loess, which, so far as their individual testimony goes, was lacustral.—*R. Ellsworth Call, Des Moines, Iowa.*

THE RODENTIA OF THE AMERICAN MIOCENE.—The following catalogue shows the affinities of the members of the order *Rodentia* found hitherto in the White river, Truckee and Loup Fork horizons of the Miocene:

SCIUROMORPHA. Squirrels.

SCIURIDÆ.

Sciurus vortmani Cope; Pal. Bull. 31, p. 1, 1879. Truckee.
Sciurus relictus Cope (Paramys); New Vertebr. Colorado, 1873, p. 3. White river.
Sciurus ballovianus Cope; Bullet. U. S. Geol. Surv. Terrs., Feb., 1881. Truckee.
Gymnoptychus minutus Cope; Pal. Bull. No. 16, p. 6, 1873. White river.
Gymnoptychus trilophus Cope; Pal. Bull., No. 16, p. 6, 1873. White river.
Meniscomys hippodus Cope; Pal. Bull., No. 30, p. 5, 1878. Truckee.
Meniscomys liolophus Cope; Rept. U. S. Geol. Surv. Terrs., IV, MS. Truckee.
Meniscomys cavatus Cope; Rept. U. S. Geol. Surv. Terrs., IV, MS. Truckee.
Meniscomys nitens Marsh; Am. Journ. Sci. Arts, 253, 1877. Truckee.

ISCHYROMYIDÆ.

Ischyromys typus Leidy; Ext. Fauna Dak., Nebr., 1869, 335. White river.

CASTORIDÆ.

Castor peninsulatus Cope, Report U. S. Geol. Surv. Terrs., IV, MS. Truckee.
Castor gradatus Cope (*Steneofiber*); Pal. Bull., 30, p. 1, 1878. Truckee.
Castor nebrascensis Leidy (*Steneofiber*); Ext. Mamm. Dak., Nebr., 1869, p. 338. White river.
Castor pansus Cope; Report U. S. Expl. Surv. W. of 100 Mer., IV, p. 297, 1877. Loup Fork.
Eucastor tortus Leidy; Ext. Mamm. Dak., Nebr., 1869, p. 341. Loup Fork.

MYLAGAULIDÆ.

Mylagaulus sesquipedalis Cope; Bull. U. S. Geol. Surv. Terrs. 1873, p. 384. Loup Fork.
Mylagaulus monodon Cope; Rept. U. S. Geol. Surv., IV, MS. Loup Fork.

? FAM.

Heliscomys vetus Cope; Synopsis New Vert., Colorado, 1873, p. 3. White river.

MYOMORPHA. Mice, etc.

MURIDÆ.

Eumys elegans Leidy; Ext. Mamm. Dak., Nebr., 1869, p. 342. White river.
Hesperomys nematodon Cope; Pal. Bull., No. 31, p. 1, 1879. Truckee.

Hesperomys loxodon Cope; Report U. S. Expl. Surv. W. of 100th Mer., IV, p. 300. Loup Fork.

Paciculus insolitus Cope; Pal. Bull., No. 31, p. 2, 1879. Truckee.

Paciculus lockingtonianus Cope; Bull. U. S. Geol. Surv. Terrs., 1881, p. 176. Truckee.

GEOMYIDÆ.

Entoptychus planifrons Cope; Pal. Bull., No. 30, p. 3, 1878. Truckee.

Entoptychus lambdoideus Cope; Report U. S. Geol. Survey, Terrs., IV, MS. Truckee.

Entoptychus minor Cope; Report U. S. Geol. Surv. Terrs., IV, MS. Truckee.

Entoptychus cavifrons Cope; Pal. Bull., No. 30, p. 2, 1878. Truckee.

Entoptychus crassiramis Cope; Pal. Bull.. No. 30, p. 3, 1878. Truckee.

Pleurolicus sulcifrons Cope; Pal. Bull., No. 30, p. 4, 1878. Truckee.

Pleurolicus leptophrys Cope; Report U. S. Geol. Surv. Terrs., IV, MS. Truckee.

Pleurolicus diplophysus Cope; Report U. S. Geol. Surv. Terrs., IV, MS. Truckee.

HYSTRICOMORPHA.

HYSTRICIDÆ.

Hystrix venustus Leidy; Ext. Mamm. Dak., Nebr., 1869, p. 343. Loup Fork.

LAGOMORPHA. Rabbits.

LEPORIDÆ.

Panolax sanctæfidæi Cope; Report U. S. Expl. Surv. W. of 100th Mer., IV, p. 296. Loup Fork.

Palæolagus agapetillus Cope; Pal. Bull., No. 15, p. 1, 1873. White river.

Palæolagus haydeni Leidy; Ext. Mamm. Dak., Nebr., 1869, p. 331. Truckee and White river.

Palæolagus turgidus Cope; Pal. Bull. No. 16, p. 14, 1873. White river.

Palæolagus triplex Cope; Pal. Bull., No. 16, p. 14, 1873. White river.

Lepus ennisianus Cope; Report U. S. Geol. Surv. Terrs., IV, MS. Truckee.

SUMMARY.

	Genera.	Species.
Sciuromorpha	8	17
Myomorpha	5	13
Hystricomorpha	1	1
Lagomorpha	3	6
	17	37

—*E. D. Cope.*

A NEW CLIDASTES FROM NEW JERSEY.—Professor Samuel Lockwood, of Rutgers College, recently discovered part of the skeleton of a large Mosasauroid reptile near Freehold, Monmouth county, New Jersey, which he sent me for examination. It proves to be a *Clidastes*, and much larger than any of the species of the genus hitherto known, having the dimensions of the *Liodon validus*. The parts preserved include numerous vertebræ, the greater part of the lower jaw with some teeth; a humerus and ulna nearly perfect; a nearly entire coracoid, and parts of both scapulæ. Besides the zygosphene articulation, the species displays other points of resemblance to the known species of *Clidastes*, as the narrow articular surfaces of the lateral joint of the lower jaw, the slender dentary bone and the very robust humerus. The extremity of the dentary bone is broken off. There are sixteen teeth and alveolæ on the portion preserved, and there were probably two or three others on the lost portion. The teeth differ from those of the known species in their subcircular instead of lenticular section. The middle teeth have fore and aft cutting edges, and are not faceted. The anterior teeth have no posterior cutting edge, and resemble in form those of *Platecarpus*. The enamel in all is smooth. The coracoid has a deep fissure extending towards the foramen. The humerus is wider distally than it is long. There are eight cervical vertebræ preserved, including the atlas and axis. The articular faces of the centra of these are a little wider than deep, and subcordate in form. The articular surfaces of the dorsals are relatively a little deeper, but are distinctly depressed. A distal caudal is also wider than deep, and of subquadrate outline. The chevron bones are coössified.

Probable length of dentary bone m. .620; depth of do, at fifth tooth from behind .077; diameters of crown of eighth tooth from behind, anteroposterior .018, transverse .016; diameters of cup of a cervical vertebræ, vertical .056, transverse, .066; do. of a dorsal, vertical .058, transverse .066. Length of humerus .130; distal width .160. Width of coracoid .225.

The species may be called *Clidastes conodon*.—*E. D. Cope.*

THE INTERNATIONAL GEOLOGICAL CONGRESS.—The International Geological Congress, which held its first session at Paris, in 1878, will meet again in Bologna, on the 26th September next under the presidency of M. Sella. Its success is assured by the generous liberality of the King of Italy, its protector. During the congress a geological exposition will be opened, for which important material has been sent. Professor M. Capellini of the University of Bologna, president of the committee on organization, will distribute the programme for the coming session, comprising different excursions of much interest to Imola, Poretta, Carrara, Pisa and Florence. The report of the international commission appointed in 1878 for the preparation of simplified geological nomenclature and conventional signs for the charts will also be addressed to the subscribers. The last question is open for competition, for which the king has set aside prizes awarded by jury. The memoirs for this competition must be in the hands of M. Capellini in Bologna by the 1st of June. The subscription amounts to twelve francs, and should be sent to treasurer of the Geological Society of France, 7 rue des grands-Augustins, Paris. The receipt will be forwarded immediately, and entitles the member to his ticket, to be delivered in Bologna on the 20th of September, and also to the Proceedings and other publications of the Congress.—*Revue Scientifique,*

GAUDRY ON STEREORHACHIS.—Professor Gaudry exhibited to the French Academy of Sciences, May 16, a block of the Permian of Igornay containing the bones of the Saurian named by him *Stereorhachis dominans*. It is the finest specimen of a quadrupedal animal yet found in a Palæozoic formation. The size of the specimens readily permits study of the curious scales formed like spines, which cover the belly in this species, the *Euchirosaurus* and the *Actinodon*. When these animals turned upon their backs, they presented these scales, and a strong entosternum and episterna, all supported by strong ribs, and were unassailable.

DILLER'S FELSITES OF THE REGION OF BOSTON.—A Geological Series of the Bulletin of the Museum of Comparative Zoölogy of Harvard University has been commenced, the second number of the volume being an essay on the felsites and the associated rocks north of Boston, by J. S. Diller.

GEOLOGICAL NEWS.—The Journal of the Geological Society of London for January, 1881, contains several articles of unusual interest. First is a paper on the structure of the spiral arms in several families of the Brachiopoda, by Thos. Davidson, which is largely based on specimens worked out very beautifully by the Rev. Norman Glass. Secondly, Descriptions of some specimens of pterodactyles of the genus *Ornithochirrus* from the Cambridge Upper Greensand, by Professor H. G. Seeley. Third, The relation of the Escharoid forms of Oölitic Polyzoa, by F. D. Longe, F.G.S. Fourth, New species of fossil fishes from the Black band iron stone near Edinburgh, by Dr. Traquair.——In the number of the Proceedings of the American Philosophical Society for January–June, 1881, Professor J. J. Stevenson gives an account of the geology of the south-western counties of Virginia. Professor Cope publishes a systematic analysis of the families and genera of the *Perissodactyla*, and of the species of *Triplopidæ*; also a note on the structure of the hind foot of *Toxodon*, which he finds to refer the *Toxodontidæ* near to or among the *Proboscidea*.——Miss Agnes Crane, of Brighton, England, author of various palæontological papers, is at present traveling in this country accompanied by her father.——Professor Weatherby, of Cincinnati, has recently discovered, in Kentucky, some huge crinoids with bodies a foot in diameter.——A specimen of *Rhinoceros (Cœlodonta) merki* was recently found imbedded in the ice of a tributary of the Lena river, Siberia. It was almost entire, with the flesh in good preservation. The head and foot only were preserved; the former is now at St. Petersburg.——Professor W. C. Kerr in the Transactions of the American Inst. of Mining Engineers describes the mode of occurrence of mica in North Carolina. It is found in irregular masses in vein-like beds of felspathic granite of very coarse texture in the Laurentian formation. The masses of felspar sometimes weigh several tons, and a single block of mica has been known to make two full two-horse wagon loads. The sheets sometimes measure three or four feet in diameter.

GEOGRAPHY AND TRAVELS.[1]

African Exploration.—The April number of the Royal Geographical Society's *Proceedings* notices an interesting report received by the London Missionary Society from their mission at Mtowa, on the western shore of Lake Tanganyika, in Northern Uguha, concerning the country and its people. Uguha is divided by the Lukuga river into two districts, northern and southern. Northern Uguha has a population of probably from 15,000 to 20,000, and the largest village is Ruanda, with from 500 to 600 houses. Mtowa, near which the missionaries have settled, is a village of the average size, containing ninety houses and some 300 inhabitants. It is enclosed by a semi-circle of hills, which start from Southern Ugoma, trend inland for some distance, and reach the lake shore at Cape Kahangwa. Beyond these hills stretches the plain of Ruanda, watered by several small streams, of which the Lugumba is the only one of importance. The domestic animals of Uguha are goats, sheep and fowls, but some of their chiefs possess pigeons obtained from Marungu or Ujiji. The only cattle are those belonging to the mission, though some are occasionally brought across the lake to be taken into the interior. There are said to be numerous wild animals in the hills to the north, among which are buffaloes, gorillas, leopards, monkeys, wild boars and antelopes, but hyenas are unknown. Good timber is not very plentiful except at some distance inland, where teak and other trees abound. Maize and millet are the only grain cultivated, though near the lake the land is in parts suitable for rice and also for the sugar-cane. Micaceous slate is found in abundance almost everywhere. The natives of Uguha are peaceable and industrious on the whole, but rather given to drink at the close of the harvest. Physically they are a fine people, men of over five feet eight inches being the rule rather than the exception. The Waguha are chiefly distinguished from their neighbors by the peculiar mode of dressing the hair and by the fact that the men chip the two front teeth and the women are profusely tattoed. There is but little, however, to distinguish them from the Warua, except a slight difference of language. Their first chief is said to have come from Ugoma and settled near Cape Kahangwa, where he was joined by people from Urua and Marungu.

As regards clothing, the women wear two or three pieces of fiber cloth dyed in two colors, while the men wear one large piece tucked under the belt, some also using the skins of monkeys and other animals, as well as foreign cloth.

Kasanga, of Ruanda, is said to be chief of all Uguha, but he in his turn is subject to some one else. In the villages regard is had to precedence in the arrangement of the houses, the *Walingwena*, or slaves, living in one part and the *Wabangi*, or freemen, in another.

[1] Edited by Ellis H. Varnall, Philadelphia.

The latter have elders, or *Watwita*, who represent them in the council of the elders.

On the outside the houses appear like beehives, but the inside walls are perpendicular and some four feet high. From these walls springs the roof, the center of which is ten or twelve feet from the ground, but there is no center post, and the rafters are simply fastened by rings of cane from the center downwards. On the outside, grass is laid very thickly and made to reach the ground. The interior is kept scrupulously clean by the women, and order appears to prevail in the arrangement of everything.

The trade of the country consists chiefly of ivory from Urua, Ubudjwe and other districts and in home-grown corn. Of late years the men have shown a disposition to travel, visiting Unyanyembe and even Bagamoyo and Zanzibar, Some go as porters in Arab caravans and others on ventures of their own.

Further interesting details are given concerning the domestic life, musical instruments, modes of burial and religious notions of the Waguha.

At the meeting of the Berlin Geographical Society, held on March 5, 1881, it was announced that several letters had been received from Dr. E. Junker, who at the commencement of last year undertook at his own expense a second voyage to Africa, for the purpose of exploring those portions of Central Africa first made known to us by the travels of Dr. Schweinfurth. The most recent of these letters was dated from the Monbuttu country, September 1, 1880. After a lengthened sojourn at Meschera-el-Rek, on the banks of the Bahr-el-Gazal, Dr. Junker had penetrated in a south-west direction through the land of the Bougo or Dohr negroes into the territory of the Niam Niam, by the inhabitants of which, falsely described as anthropophagi, he was received in a most hospitable manner. In the settlement of the chief, Ndoruma, he built himself a hut supplied with every comfort, and here, in the enjoyment of perfect repose, he worked out the reports of his journey, which have already reached home. Thence, in the month of August, he proceeded in a south-west direction into the territory of Pulembata, and afterwards in a south-south-east direction into the country of the Monbuttu. His letter of the first of September, above mentioned, was dated from the limits of the territory of the Mangballa, a day's journey north of the Welle. The traveler proposes to cross the Welle and to visit the Mombanga, a tribe of Monbuttu, and finally to penetrate in a north-west direction amongst the A-Madi. All these territories are as yet unexplored, as they are situated to the westward of Dr. Schweinfurth's track, and there was reason to hope that the traveler, whose state of health was perfect, would successfully carry out his intentions.

On April 1st the French Geographical Society gave a reception to Dr. Lenz, on his return from Timbuktu. The successful traveler gave some interesting details on the present condition of Timbuktu. Its houses are built of brick, and the population is now only 20,000. It has greatly decayed, and the inhabited part of the town is surrounded by great spaces covered with ruins. There are numerous schools and rich libraries. Dr. Lenz had a cordial reception, and every night during his twenty days' stay he was present at religious conferences which the learned men of the city held with his interpreter. The commentaries on the Koran formed the only subject of conversation. Timbuktu is united with the Niger three miles off by a series of lakes formerly canals. Dr. Lenz has also made some interesting observations on the Sahara, tending to confirm the conclusions of Rohlfs and other recent scientific travelers, as to the variety which is to be met with in the great desert. It is really a plateau about 300 meters in altitude, no part of it being below the level of the sea. Granite hills, sandy plains, shallow lakes, fertile oases alternate over nearly the whole surface, while beasts of prey are rarely to be met with. Dr. Lenz does not advocate the construction of a railroad from the Niger to Algeria.

No fewer than seven different languages are spoken on one side of Lake Nyassa, which is only 350 miles in length, and natives from the southern end cannot understand those at the northern.

The Algerian missionary expedition has established a station in Urundi at the head of Lake Tanganyika. It is a country whose physical features are strongly marked, a chain of treeless mountains traversing it from north to south. The population is numerous, but very timid. They appear to be agricultural in their habits, manioc, bananas, beans, etc., being largely cultivated. Although there are some marshes, Urundi is reported to be healthier than Ujiji, an additional recommendation being the entire absence of Arabs. The Wabikari, who live near where the missionaries are settled, have shown themselves well disposed, though they have the reputation of being thieves and enemies to all strangers. They were anxious for the party to settle among them on their arrival, but, the Bikari district lying low, it was thought wiser to occupy the right bank of the Murembué, which appeared a healthier site.

After the completion of seventy or eighty miles, the road from Dar-es-Salaam to Lake Nyassa has been temporarily discontinued. Its superintendent is now employed by the Sultan of Zanzibar exploring the neighboring region. This road has already had an excellent, even marvelous, effect upon the natives. Dr. Kirk, of Zanzibar, has recently passed over it for some forty miles in company with a naval officer. He reports that it is now quite safe for unarmed travelers, although but two or three years ago no one would have ventured in the neighborhood without a large escort.

The *Academy* states that "one of the objects of Mr. Jas. Stewart's late visit to the head of Lake Nyassa was to ascertain how far the Kambwe lagoon could be made available as a harbor for the missionary steamer from Livingstonia. During his investigations he made a curious discovery with regard to the River Rukuru, which until about two years ago flowed through the lagoon. He found that this river had changed its course, and that its former bed had silted up and is now even higher than the surrounding ground. This unusual occurrence he accounts for in the following way: During the rainy season the country is under water for miles, so the Rukuru flowed in a course marked by reeds and had for its banks the standing water of its own overflow. The heavy sand was rolled down the channel from the higher ground and deposited over its whole length until it was raised to such a height that the current was forced into another channel. In further explanation it should be mentioned that the Rukuru, in the last fifteen miles of its course, winds through precipitous valleys and falls upwards of 2000 feet, washing far into the lake large quantities of blueish-gray silt."

A road between Lake Nyassa and Tanganyika is projected.

The *Athenæum* states that "two important maps bearing upon the geography of Africa have been published in the *Mittheilungen*. The first exhibits the preliminary results of Herr Clemens Denhardt's explorations of the Tana River, which that explorer ascended and carefully surveyed almost to the foot of the eastern buttresses of snow-clad Kenia. Herr Denhardt found the river to be navigable throughout, and as its banks are inhabited by peaceable Wapokomo and Galla, he considers it to present many advantages for penetrating to Mount Kenia or to Lake Zamburu, in the Galla country to the north. We, therefore, direct the attention of intending explorers to this locality, for hardly anywhere else in Africa can substantial discoveries of equal interest be accomplished within so short a distance from the coast. The second map, almost equally important, exhibits Dr. Junker's journey up the Khor Baraka, from its mouth to the south of Suakin, as far as Belagenda. Herr Hasentine, the compiler of this map, has embodied in it all the information available with respect to the country it embraces."

GEOGRAPHICAL NEWS.—Two English engineers, Lieutenants Conder and Mantell, are about to commence the survey of Eastern Palestine. It is estimated that the work will take five years to accomplish.——Mr. Leigh Smith expects to pay another visit to Franz-Josef Land this summer.——In an appendix to Captain

Markham's "Polar Reconnaisance," Sir Joseph Hooker, in treating of the botanical specimens collected in this voyage to Novaya Zemlya observes: "Comparing, then, the floras of the three high Arctic meridians of Novaya Zemlya, lat. 70°–77°, long. E. 60°; Spitzbergen, lat. 76½°–80½°, long. E. 20°; West Greenland and Smith's Sound, &c., lat. 71°–82°, long., W. 60°–70°, we find that they present great differences, Greenland being the most remarkable: 1. From the number of species of European types it contains which there reach so very high a parallel. 2. From differing more in its flora from Spitzbergen and Novaya Zemlya than these do from one another; and, 3, From the absence of Arctic *Leguminosæ*, *Caltha* and various other plants that extend elsewhere around the Arctic circle. These facts favor the conclusion which I have expressed in the Appendix to Sir George Nare's Narrative (II, 307), that the distribution of plants in the Arctic regions has been meridional, and that their subsequent spread eastward and westward has not been sufficient to obliterate the evidence of this prior direction of migration. To this conclusion I would now add that whereas there is no difficulty in assuming that Novaya Zemlya and the American Polar Islands have been peopled with plants by migration from the south, no such assumption will explain the European character of the Greenland, and especially the high Northern Greenland vegetation, the main features of which favor the supposition that it retains many plants which arrived from Europe by a route that crossed the Polar area itself when that area was under geographical and climatal conditions which no longer obtain."——In a lecture delivered recently before the Society of Arts, in London, by Mr. Edward Whymper on Chimborazo and Cotopaxi, he dwelt at some length on the sickness experienced when at great elevations, the result of the diminution in the atmospheric pressure. He found the distress mitigated by doses of ten grains of chlorate of potash every two or three hours. After suffering for several days on Chimborazo, during which he persevered and ascended to a height of 17,400 feet, his condition improved, and finally he was restored to his normal state, so that after a residence of seventeen days on the mountain, passing the nights at heights varying from 14,400 to 17,300, all trace of mountain sickness had disappeared.——Lieutenant Karl Weyprecht, the discoverer, with Lieutenant Payer, of Franz-Josef Land, died on March 29th, at the age of forty-three. ——The Bremen Geographical Society propose to send an exploring expedition to the Tchuktche Peninsula, Northern Siberia.——At a recent meeting of the Paris Geographical Society, M. Dutreuil de Rhins identified Nabchu, where Colonel Prejevalsky was obliged to stop when only about 180 miles from the capital of Tibet, with Abbé Huc's Na-ptchu, about 32° 10′ N. lat., 89° 30′ long. E. from Paris.——The winter of 1880–81, so remarkable for its severity in America and Europe, was one of unusual mildness in Siberia.

MICROSCOPY.[1]

Recent American Books on Microscopy. — *Compendium of Microscopical Technology*, by Carl Seiler, M.D., pp. 130, Philadelphia, 1881.—This book, while designed as a guide for beginners, will also be of frequent use to more experienced workers. It is intended as a guide for physicians and students in the use of the microscope, and in the prepartion of histological and pathological specimens for examination. Without attempting to give a comprehensive discussion of all the new or even of the most important standard methods of examination and preparation of objects, the author simply describes a few methods and expedients which he has himself fallen into the habit of using, and which he is, therefore, able to endorse as uniformly satisfactory, and to describe with that clearness, fullness and precision which should be characteristic of a working handbook. After a short and judicious chapter on the structure and use of the microscope, including a few of the most simple and indispensable accessories, practical directions are given for preparing, cutting, staining, injecting and mounting animal tissues, with separate chapters on preparation of vegetable tissues and insects, and photo-micrography. Description of the tissues themselves is omitted throughout; except that a synoptical table of the more common tumors and neoplasms is given as an appendix, which is one of the most valuable portions of the book. Two or three of the formulæ are given in the metric form, and some others in "parts," which in this case amounts to about the same thing; and the beautiful simplicity of these, and the self-evident proportion of their different constituents, gives an interesting contrast to those clumsy ones which are still given in grains, drachms, ounces and drops.

Practical Hints on the Selection and Use of the Microscope, by John Phin, editor of the *Am. Journ. of Microscopy*, pp. 231, New York, 1881.—The third edition of a book so well known as this little manual needs no commendation. Introduced six years ago as a popular handbook, of extreme simplicity, for the use of beginners, it still retains the same character, though with such extensive additions and improvements that the last edition may be considered a new book. Three quarters or more of the work are given to a description of the microscope and its various accessories, and the remaining portion to the collection and preservation of objects. The whole is characterized by its sound common sense, and its practical utility. Probably no book on the subject, really adapted to beginners and presuming so little on their previous education, contains so much of valuable and interesting information.

Handbook of Systematic Urinary Analysis, Chemical and Microscopical, for the use of Physicians, Medical Students and Clinical Assistants, by Frank M. Deems, M.D., pp. 30, N. Y., 1880.—This

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

little essay furnishes in a tabular form a synopsis of a chemical and microscopical analysis which can, by its aid, be carried out with great facility by any person accustomed to such manipulation and familiar with the appearance of the objects sought for. Such a manual should not and cannot be made to take the place of more thorough treatises on the same subject, but as an adjunct to them it is a great convenience and time-saver, alike to beginners who are lost in the multiplied details of the larger books and need a guide-book to them, and to experienced men of business whose crowded time compels them to refresh their memories in the easiest possible way.

How to See with the Microscope, by J. Edwards Smith, M.D., pp. 410, Chicago, 1880.—The most valuable portions of this work are the various suggestions in regard to the manipulation of the modern wide-angled objectives, which are scattered throughout the work, though given more particularly in the form of lessons in the latter pages of the book. It is greatly to be regretted that the really useful ideas should be buried in such a vast amount of personality and of (to say the least) irrelevant discussion.

Fresh-water Rhizopods of North America, by Joseph Leidy, M.D., 4to, pp. 324, Washington, 1879, and *Synopsis of Fresh-water Rhizopods*, compiled by Romyn Hitchcock, F.R.M.S., pp. 56, New York, 1881.—The superb work on Fresh-water Rhizopods by Professor Leidy has lately made the study of these organisms easy as well as charming. His treatise is a scholarly and dignified work, upon a class of objects hitherto studied with difficulty on account of the fragmentary and scattered character of the data that were available to students. The present work, published by the Department of the Interior as a portion of the U. S. Geological Survey of the Territories, is well printed and sumptuously illustrated, and is a credit not only to the author and to the survey of which it forms a part, but also to American science.

As Dr. Leidy's work is already becoming scarce, and will soon be unattainable, except occasionally and at high price, Professor Hitchcock has prepared a brief abstract of the subject, based upon it, and published it as stated above. Brief descriptions of the genera and species are given, with scarcely any variations from the original, except those which were made necessary by the absence of illustrative plates. It is believed that these descriptions will enable the student to name his species without the aid of figures; and that this little book will be of use even to those who possess Dr. Leidy's larger book, serving as an analytical key to that, and leading the student directly to the proper genus or species. As many will use this small book who have not access to its larger predecessor, the want of plates will be much felt, and an appendix in the form of a sheet or two of engravings of typical species would probably find ready sale among the owners of the book.

The Student's Manual of Histology, by Charles H. Stowell, M. D., pp. 279, Detroit, 1881.—This modest book is really one of the most useful of recent publications. After a brief chapter on the microscope and mounting apparatus and reagents, some twenty chapters are given upon the microscopic anatomy of the various organs of the body, with an additional chapter on tumors and one upon starches. The descriptions of the tissues are concise, pithy and clear, and abundantly illustrated by nearly two hundred woodcuts. The directions for preparing and examining the various tissues are not loaded down by a great variety of untried methods, but are confined to a few methods which are in very general use or have become favorites with the author. Altogether the book, while not competing with the large manuals for use by scholars and teachers, is a most excellent handbook for the student, whether in the study or in the laboratory. Much credit is due for the care taken to add a statement of the magnifying power to the engravings, but it is to be hoped that other authors will go still further, and that, ere long, no engraving will be considered worth copying which lacks this essential feature.

Prizes for Microscopical Essays.—The Boston Society of Natural History offers a first prize of from $60 to $100 and a second of $50 for the best memoirs in English upon the following subjects: The occurrence, microscopic structure and use of North American fiber-plants; treating especially of the fibers employed by the Native Races; and original, unpublished investigations respecting the life-history of any animal. Prizes for papers on the first subject will be awarded in April, 1882, and on the second subject in April, 1883, provided the papers offered are deemed of adequate merit. Further particulars can be obtained from Edward Burgess, secretary of the society.

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SCIENTIFIC NEWS.

— Dr. J. J. Bigsby, well known as a writer on the geology of British America, and author of Thesaurus Siluricus, and founder of the "Bigsby Medal," died in London, Feb. 10, 1881. The death of Dr. Barnard Davis, the distinguished craniologist, occurred at Hanley, England, late in May. He was joint author with Thurnam of "Crania Brittanica." His collection of skulls, said to be the largest in existence, has recently been purchased by the Royal College of Surgeons. Another loss to English science was the death, early in April, of Sir Philip Egerton, one of the highest authorities on fossil fishes. M. Delesse, a distinguished French geologist, died in Paris in March, aged 63.

— Book of the Black Bass, by James A. Henshall, M.D., is announced to be published by the author by subscription, 33 Wesley avenue, Cincinnati, Ohio.

— The municipality of Marseilles has granted a subsidy towards the laboratory of marine zoölogy proposed to be established on the Gulf of Lyons. In this connection appears in the *Academy* the statement that a dredging excursion in the Australian seas, organized in connection with the Sidney Museum, has made extensive collections of marine life.

— The thirtieth meeting of the American Association for the Advancement of Science will begin at Cincinnati at 10 o'clock Aug. 17th. It is expected that this meeting will be the largest and most important ever held in the West. The headquarters of the Association will be at Music Hall.

— The reptiles and fishes of Australia have been made known, largely through the efforts of Mr. Gerard Krefft, who was the curator of the Sidney museum. His death in February last at the age of fifty-one, has been announced in *Nature*.

— The dinner of the New York Ichthyophagous Club took place at Glenn's island (off New Rochelle, N. Y.), on May 27th. The *menu* was as follows:

Little Neck clams. Sauterne.
Potages.
Consommé of Mossbunker.
Bisque of Razor clams. Amontillado.
Hors d'œuvre.
Boudins of Graysnapper à la Blackford.
Horseshoe crabs à la diable.
Sardines. Anchovies.
Relevés.
Drum à la Cope. Filet de bœuf à la Richelieu.
Pommes duchesse. St. Emilion.
Entrées.
Raie au beurre noir.
Sheepshead à la Normande.
Sauté of shark, Chinese style.
Squid à la Starin.
Pain de menhaden à la Goode.
Asperges. Niersteiner.
Sorbet des Princes.
Rôti.
Striped bass à la Mather. Pommery.
Gibier.
Hell-benders, Sea robins, Angle-worms,
Pieces Froides.
Lophius à la Baird. Sturgeon à l'Ichthyophage.
Salade.
Sea Weed.
Dessert.
Glaces nautiques, Petits fours, Fruits,
Fromages, Café.
Liqueurs.

The object of the society is to test and introduce to notice articles of food, derived from fresh and salt water, whose merits are generally unknown to American scientists and epicures. On the occasion in question considerable progress was made in this direction, while the guests were entertained by humorous speeches and music. The following programme for the band was presented:

The Torpedo and the Whale	Audran.
Marchande de Marée	Lecocq.
One day I caught a Fish	Planquette.

One of the editors of the NATURALIST who was present and enjoyed the occasion, makes the following report on the merits of some of the more novel dishes.

Bisque of razor clams *(Solen)*, very delicate.

Consommé of Mossbunker *(Brevurtia menhaden)*, strong and oily.

Horse-shoe crabs *(Limulus polyphemus)*, good, equal to the best devilled crabs.

Drum *(Pogonias chromis)*, very flat.

Raie au beurre noir *(Raja)*, tender but tasteless.

Sauté of shark steaks (man-eater, *Eulamia milberti*, said to have recently eaten a negro), tender and with good flavor.

Squid a la Starin *(Loligo* sp.), rather tasteless.

Hellbenders *(Protonopsis horrida)* (to be now called in deference to the new revision N. T., hades-benders), good, much like frogs' hind legs.

Beyond this the editor did not extend his researches. He desires to express his acknowledgment to Messrs. John Foord, president, and Eugene Blackford, of the committee of arrangements, for especial favors.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BOSTON SOCIETY OF NATURAL HISTORY, May 4.—Annual meeting. The annual reports of the curator, secretary and treasurer were presented, and the officers for 1881-2, elected. Dr. H. P. Bowditch spoke of the distribution of the papillæ on the skin, and Dr. C. S. Minot remarked on the young stages of the embryo chick, both subjects being illustrated by lantern projections.

M. v 18.—Dr. M. E. Wadsworth remarked on a microscopic examination of the Iron ore (Peridotite) of Iron Mine Hill, Cumberland, Rhode Island; Mr. F. W. Putnam gave an account of his recent archæological explorations in the Little Miami valley in Southern Ohio; Professor E. S. Morse spoke of the agricultural implements of Japan; and Mr. W. W. Dodge gave a few details of local geology.

NEW YORK ACADEMY OF SCIENCES, May 30.—Mr. A. A. Julien read a paper on the identification of the so-called "porphyry" connected with western lodes; Professor J. S. Newberry remarked on the relations of the Cretaceous rocks of North America to those of the old world.

American Geographical Society, May 10.—Mr. J. Douglas, Jr., read a paper on Chili; its geography, people and institutions.

Appalachian Mountain Club, May 21.—An excursion of the members was made to Doublet hill, Weston, and one to Mt. Greylock *via* the Hoosac Tunnel, was projected for June 17th. At the meeting held June 8th, Mr. H. Murdock read a paper on the region surrounding the Smith's River valley, N. H., and Mr. S. H. Woodbridge gave a description of the scenery about Williamstown, Mass.

Troy Scientific Association, Feb. 21.—Dr. R. H. Ward read a paper on the recent teachings of the microscope in regard to different kinds of blood.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

Annals and Magazine of Natural History. January.—Spolia Atlantica; contributions to the knowledge of the changes of form in fishes during their growth and development, especially in the pelagic fishes of the Atlantic, by C. F. Lütken.

Annals and Magazine of Natural History.—April. General considerations upon the carcinological fauna of great depths in the Carribean sea and Gulf of Mexico, by A. Milne-Edwards.

American Journal of Science, June.—Geological relations of the Limestone belts of Westchester county, New York, Southern Westchester county and Northern New York island, by J. D. Dana. Fossil fishes from the Devonian rocks of Scaumenac bay, Province of Quebec, by J. F. Whiteaves. New Jurassic mammals, by O. C. Marsh.

Canadian Naturalist.—April 30. Palæontological notes, by J. W. Dawson. Notes on the geology of the Peace River region, by G. M. Dawson. On the glacial phenomena of the Bay Chaleur region, by R. Chalmers.

Zeitschrift für wissenschaftliche Zoologie.—April 22. The organ of smell and the nervous system of mollusks, by J. W. Spengel. (The olfactory organ is composed of a pair of olfactory ganglia united with an epithelial organ of hearing, the entire apparatus connected by commissures with the visceral ganglia). Process of self-division in *Euglypha alveolata*, by A. Gruber. The developmental history of the Amphipoda, by B. Ulianin (with an exquisite colored plate). On molluscan eyes of an embryonic type, by P. Fraisse. The white of the egg-gland of Amphibia and birds, by P. A. Loos.

Geological Magazine. May.—The mammoth in Europe, by H. H. Howorth; glaciation of the Shetland, by D. Milne Home; Geology of British Columbia, by G. M. Dawson.

Errata.—P. 363, line 19, for *Macerna* read *Macoma*. P. 365 line 21, for Japanese parts read Japanese ports.

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THE GREAT CRESTED FLYCATCHER.

BY MRS. MARY TREAT.

LAST spring a pair of noisy great crested flycatchers abandoned their usual nesting place in the woods, and resolved to take up their abode among civilized birds.

It is only a few years since the wood pewee was first observed to leave the dark woods and nest around our dwellings. This little bird builds a neat compact nest which it glues fast to the limb of a tree, and lines it with some soft material. In Southern New Jersey it often uses the silky down of the cotton grass (*Eriophorum virginicum*) for a lining. It covers its nest externally with lichens, very much after the fashion of the hummingbird. This charming little flycatcher is now one of our most confiding, familiar birds. It will be interesting to learn if the great crested flycatcher has also concluded to become civilized, or is it simply a freak of one pair of birds?

Audubon says of this species, "The places chosen by the great crested flycatcher (*Myiarchus crinitus* Linn.) for its nest are so familiar, and the composition of its fabric is so very different from that of all others of the genus with which I am acquainted, that perhaps no one, on seeing it for the first time, would imagine it to belong to a flycatcher. There is nothing of the elegance of some or the curious texture of others displayed in it. Unlike its kinsfolk, it is contented to seek a retreat in the decayed part of a tree, of a fence rail, or even of a prostrate log moldering on the ground. I have found it placed in a short stump at the bottom of a ravine where the tracks of raccoons were as close together as those of sheep in a fold. In all these situations our bird seeks a place for its nest, which is composed of more or fewer materials as the emergency may require, and I have observed that in nests nearest to the ground the greatest quantity of grass, fibrous roots, feathers, the hair of different quadrupeds, and the exuviæ of snakes was accumulated. The nest is under the above circumstances at all times a loose mass. Sometimes when at a great height, very few materials are used, and in more than one instance I have found the eggs merely deposited on the decaying particles of the wood, at the bottom of a hole in the broken branch of a tree, sometimes of one that had been worked out by the gray squirrel."

In "Wilson's Ornithology," we find the following with regard to the nesting habits of this bird: "The great crested flycatcher arrives in Pennsylvania in May and builds his nest in a hollow tree deserted by the blue-bird or woodpecker. The material of which this is formed is scanty or rather novel. One of these nests now before me is formed of a little loose hay, feathers of the guinea fowl, hogs' bristles, pieces of cork, snake skins and dogs' hair. Snake skins with this bird appear to be an indispensable article, for I have never found one of his nests without this material forming a part of it. Whether he surrounds his nest with it by way of terrorism to prevent other birds or animals from entering, or whether it be that he finds its silky softness suitable for his young, is uncertain; the fact, however, is notorious."

So it seems that heretofore the great crested flycatcher has been content with any old tree or stump that afforded him a cavity into which he could gain access. But now the little bird-houses in the vineyard, scattered about on the posts, attract his attention much to the chagrin of the bluebirds and wrens. Apparently unconscious of this, the pair proceed with their house hunting much after the fashion of human bipeds.

The male stations himself on one of the little houses, and with his harsh voice calls his mate. She comes and inspects the house, but seems to have some objection, so they go the rounds, even looking into those already occupied by bluebirds, but they do not molest them.

A male bluebird is watching the pair from an adjacent grape post as they visit his home. The flycatcher is stationed on the top of the house and screaming for his mate. She comes and merely looks in and finds the female on the nest and immediately flies away, but the male stays awhile and continues to call, evidently thinking that she did not half look at the house, but she does not return, and as he flies away, the bluebird who was watching him at a safe distance, now courageously flies after him and then returns to his mate who meets him at the door, and they chatter over the matter in their low, sweet way, he apparently telling her how he has driven the hateful fellow away!

The flycatchers next visit a little house fastened to the railing of an upper piazza, but this too is occupied by a family of bluebirds, and they leave them unmolested. At last madam flycatcher chooses the finest establishment on the premises—a three-storied octagon house surmounted with a cupola and spire, with a weather vane and ball attached to the spire. The house is fastened to the top of the stable, and was originally intended for the martins, but a pair of bluebirds were the first to occupy it, and they have held it for several years past, allowing no other bird to get possession; but they do not try to drive the flycatchers, who finally select the cupola which they find empty.

They are beyond my reach but they do not try to prevent my seeing the material which the female carries to the house. On the contrary they seem wholly indifferent to my presence, much more so than our familiar bluebird.

The male always precedes his mate and heralds her approach with a clamorous noise. He stations himself on the ball or weather vane above the cupola, and seems to be giving directions to his partner in a very loud voice, while she works with a perverse stick that she cannot get through the door.

She selects a stick longer than the door, and stupidly holds it about midway and tries to force it through. If it is too stout to bend or break, she works long and laboriously, while her partner looks on and screams. At last, discouraged with the hopeless endeavor, she comes to the ground and selects another. She proceeds in this way for several hours. Finally she learns to put the stick end first through the door, and now the work progresses rapidly.

They are gone longer than usual, so long that I begin to fear they have given up their elegant site, but in a few hours I again hear the harsh voice of the male, and on looking up, see the female following her mate with a streaming banner, which proves to be the indispensable snake skin.

Whether this bird, like its little congener, the wood-pewee, has at last concluded that its nest will be more safe near the habitations of man, remains to be seen.

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THE REASONING FACULTY OF ANIMALS.

BY JOSEPH F. JAMES.

MUCH as has been written on the subject of instinct and reason in animals, the question as to whether they possess reason is nearly as far from being answered as ever, and people continue to write and argue with the same pertinacity as of yore. Some writers have maintained that all the actions of animals lower than man, are performed by a something designated as instinct, and that this was a faculty given by Divine power to animals, to take the place of reason possessed only by mankind. Others have said that both animals and men have reasoning powers, but the former in such a limited degree as to be hardly noticeable. Still others contended that animals were actuated to a very great extent in their actions by reasoning faculties, and that entirely too much stress has been placed upon the power of instinct;[1] while a last party have said that neither man nor beast is possessed of reason, but that both perform all their actions automatically, and being under the influence of unchangeable law, do what they do because they cannot do otherwise.[2]

In the olden time, before we knew as much about the animal world as we do now, the unerring faculty of instinct was expatiated upon times without number. All animals were set down as without reasoning powers, and when one did perform an action out of accordance with its usual life, it was looked upon as a most remarkable phenomenon, and as instinct working in an abnormal direction. Besides, this instinct was thought to be bestowed by the Deity, directly upon the animal. In later days

[1] The latest book taking this ground is "Mind in the Lower Animals," by W. Lauder Lindsay, 2 vols, 1880.

[2] Descartes' idea of animated machines. It has for its strongest supporter Professor Huxley. See article "Are Animals Automata?" by T. H. Huxley in *Popular Science Monthly*, V, 724.

this is not so much the case, and many consider that the sooner we discard the idea of instinct, and the sooner we attempt to explain the actions of animals upon the theory of their possessing reason, just that much sooner will we be able to come to a just conclusion.

It can hardly be denied that there are some actions, which, instinctive in the ordinary sense, are transmitted from one generation to another, and are performed by all alike. Let us see if we can not find a reasonable ground for the first introduction of some of these instincts.

There was a time when the first mud wasp stung its first spider or grub, and deposited it in the first nest for the use of its young. But how do we know that this action was performed as successfully by the first female wasp, as it is now by her descendants? Would it not be just as reasonable to suppose that the present perfection of this action, if it be perfect, was the result of long experience, and of a gradual improvement from generation to generation, as to imagine that the first wasp succeeded as well as her descendants do now? There was a time when the first chicken was hatched and scratched the ground. But is it necessary to suppose that the first born of the jungle-fowl of India acted as our barnyard fowls do now, to account for the ability of the new born chicks to run over and scratch the ground? Not so. These actions, and perhaps many more, are hereditary faculties, imperfect and crude at first, but gradually improving and perfecting, and transmitted from generation to generation in the same way as a taste for engineering, a liking for science, or ambition to be a soldier, descends from father to son. The gradual development of the mind of animals and of man, is under the influence of the same laws as the development of the body.

It is probable that the first pair of jungle-fowls of India, way back in antediluvian times, hatched a brood of young ones, which stayed in the nest till fully fledged, as do the young of most all birds. Suppose an accidental event occurred, which made it advantageous for the young chick to be able to run and scratch as soon as it broke out of the shell. Suppose it was found by nature, that the chick that could run away soonest after being born, would be the one most likely to escape from the clutches of the hawk when the mother was driven from the nest. The additional safeguard of life would be seized upon, and by gradually strengthening the ability to run, it would be transmitted in an improved form through the birds which escaped by running, to their descendants, and finally be bequeathed to their posterity in the form in which we now find it. Such an explanation would apply to quail and grouse, and, in fact, to all birds which run as soon as hatched, and seek to hide themselves from their enemies in the grass and bushes. This instinct in young chickens is by no means so perfect as it might be; for any one who has noticed them when just hatched, and led by the hen, will have seen that they stumble and stagger, sometimes going head over heels in their efforts to pick something up. So that even if it were instinct, it is perfected by practice.

Then again with the wasp. The one which provided best for its offspring, would leave the most descendants; and the faculty and the ability to provide would be transmitted from generation to generation, being improved each time by the natural laws of modification with descent, and by the struggle for existence. So with the cells of the bee. Mathematicians have been struck with astonishment, and held up their hands in holy wonder, to see such an insignificant insect as a bee making a cell more mathematically accurate than they can after a lapse of 2000 years.[1] But it was a matter of necessity to use as little material and occupy as little space as possible with his cells. The ancient bees doubtless made their cells much less mathematically correct than the present ones are supposed to do.[2] And it was only when the use of less wax, and of less space, gave one hive the advantage over another in the struggle for existence, that the present cell began to appear. It was not made so because of the instinct of the bee, but because the laws of nature compelled it to be made so, if the bee would hold its own in the struggle. We know well that bees do not make their cells always exactly alike, nor as exactly hexagonal as we are often told. They depart from the regular shape,[3] and use other forms to suit circumstances, and we have here a

[1] Lord Brougham, "Dialogues on Instinct," 1844, pp. 66–70.

[2] Even the cells of the present hive bee are by no means perfect. In fact, investigations by Professor Wyman, printed in the Proceedings of American Academy of Arts and Sciences, VII, 1866, have proved "that the cells are all more or less imperfect, and that an hexagonal cell, mathematically exact, does not exist in nature, but only in theory." Packard, "Guide to Study of Insects," 1869, pp. 123–127, which see for an extended notice of Professor Wyman's paper.

[3] See Kirby and Spence, "Introduction to Entomology." Lond. ed. II, 469.

clear evidence of reasoning powers, and of the faculty of adapting means to ends.

Again we are told that many insects lay their eggs upon the leaves of certain plants, upon which the larvæ feed, and upon no others, and it is pointed out as a case in which the Almighty has endowed the creature with an instinctive knowledge of the plant. But why should it be so? The white butterfly lays its eggs upon the cabbage, and the larvæ feed upon its leaves. What right have we to say that the butterfly does not know the cabbage? There may be something about that plant agreeable to her olfactory nerves, which induces her to alight and deposit her eggs. Or it may be that in ancient days, and must have been, that the butterfly deposited her eggs upon any plant indiscriminately. If those that fed upon the cabbage throve better than those on some other plant, they would be preserved in the struggle for existence, and leaving more descendants than their rivals, would thus transmit the habit of frequenting more and more the cabbage plant. Perhaps at the time some species of insects originated, the ancestor of all deposited her eggs upon any plant most convenient. All may not have been suitable, but the larvæ throve on those that were, and frequented the same plant afterwards; and thus in feeding on different plants and leading different lives, the one original species became differentiated into distinct but allied species.

The instinct which induces the cuckoo to lay her eggs in the nests of other birds, can be shown to have arisen in much the same manner as those to which we have referred. Mr. Darwin gives an excellent account of how the instinct might be developed. He says: "Now let us suppose that the ancient progenitor of the European cuckoo, had the habits of the American cuckoo, and that she occasionally laid an egg in another bird's nest. If the old bird profited by this occasional habit through being able to migrate earlier, or through any other cause; or if the young were made more vigorous by advantage being taken of the mistaken instinct of another species, than when reared by their own mother, encumbered as she could hardly fail to be by having eggs and young of different ages at the same time; then the old birds or the fostered young ones would gain an advantage. And analogy would lead us to believe, that the young thus reared, would be apt to follow by inheritance the occasional and abberrant habits of their mother, and in their turn would be apt to lay their eggs in other birds' nests, and thus be more successful in rearing their young."[1] This explanation seems to us simple, and at the some time adequate, and the same process of reasoning applied to all instincts of like character, would with little modification be sufficient. Such instincts as the last, the hive bee cells, the case of butterflies laying eggs on plants, the slave-making habits of ants, and many more which will recur to any one, are brought into existence accidentally, and given a tendency to variation in any faculty of the mind or power of the body, and we can expect to see it modified by nature's seizing upon the favorable variations, transmitting them in an improved state each time by inheritance from one generation to another, until they reach such perfection that men are astonished, and can see no other way of accounting for the fact, but by bringing to their aid divine power and intervention.

Now we are told, that instinct is some power or principle possessed by animals, by means of which they perform, blindly and ignorantly, works of an intelligent nature; further, an impulse by which they are directed, without previous instruction or experience, to do unerringly what is necessary for the preservation of the individual or the species. The fact that instincts are not unerring, goes far to prove that they had some such origin as we have described. It is known, for instance, that butterflies and moths often lay their eggs upon plants or in positions where their larvæ can not flourish.[2] What is this but a return to a former method of proceeding, when the insect laid her eggs on any plant? Here the instinct fails utterly, and not only does not assist in the preservation of the species, but is instrumental in destroying it. Cattle are supposed to know by instinct poisonous from beneficial plants, but take them to a new country, and they at first are as likely to eat the poisonous ones as those that are not. Their so-called instinct fails, because it is not an instinct at all, but the result of experience and observation. The instinctive dread birds have of man is often spoken of; but that is no instinct either. Birds and animals of all kinds in a state of nature, where

[1] Origin of Species, 6th ed., N. Y., p. 212.

[2] Kirby and Spence, loc. cit. II, 466, say that the flesh fly sometimes lays her eggs in the flowers of *Stapelia hirsuta*, instead of in carrion, and further that the common house fly will frequently deposit her eggs in the snuff in a box.

they have never been molested, or disturbed but little, have no great dread of man, and it is only after they have learned by dire experience, and by observation, the evils likely to fall upon them from the advent of man, that they show any dread or fear of him.[1] This dread is then transmitted to their offspring, but is by no means an inherent faculty of the birds' or animals' mind.

It is said again that a marked instinct is shown in birds by their nest building. Some say the bird makes as good a nest the first time she tries, as when she becomes old and experienced. But this has been emphatically denied, and is doubtless untrue. An observer has given an account of the first and subsequent attempts of one pair of birds to build a nest; and he shows conclusively that the first was a poor specimen of bird architecture, the second was an improvement, the third still better, and so on until the art was finally reached of making a handsome and serviceable nest. Alexander Wilson, one of the best of ornithologists, believed implicitly that birds improve in nest building and gives several instances of it.[2] Birds learn to sing, too, by a long apprenticeship. At first the song consists merely of a few disconnected notes. By continual practice the art is developed, and at last the bird carols forth the lay which delights all hearers.[3] It is not the result of instinct, but of practice and gradual improvement. Mr. Wallace believes that as man performs many of his intelligent acts merely by imitation, so it is with birds in making a nest.[4]

One would think that if there is any action which is instinctive with water animals, it would be that of swimming, yet this is not always the case. A writer in *Harper's Weekly* stated that "were a young seal taken three or four weeks after birth and thrown into

[1] See Darwin's Voyage of Naturalist, pp. 398–401. In speaking of the birds of the Galapagos islands, he says: "A gun is here almost superfluous, for with the muzzle I pushed a hawk off the branch of a tree. One day whilst lying down, a mocking thrush alighted on the edge of a pitcher, made of the shell of a tortoise, which I held in my hand, and began very quietly to sip the water; it allowed me to lift it from the ground whilst seated on the vessel." The testimony of other travelers is corroborative.

[2] American Ornithology (16mo, Edinburgh edition, 4 vols. 1831), I, 179, 189–190 See also article by Dr. Brewer, "On Variation of the nests of the same species of Birds." Am. Nat. xii, 35. Wallace, "Contributions to Natural Selection," p. 227. Article from "Revue des Deux Mondes" in *Pop. Sci Monthly*, II, 485, and others.

[3] Darwin's "Descent of Man," 1st. ed., I, 53 and 54. Wallace, ibid, p. 220, et seq.

[4] Wallace, ibid. "Essay on Philosophy of Birds' Nests."

deep water, it would drown miserably in a few minutes; they begin to grow accustomed to the water at the end of three or four months by degrees, and it takes a pup about three weeks' practice at the surf margin before it can handle its flippers properly in the water." Here instinct is out of the question, for to be that, the ability to swim would be manifested almost at birth.

We have granted that some animals are possessed of instincts, but we deny that these are implanted by divine agency, and contend that they come into existence in obedience to natural laws. We contend also that outside of these instincts proper, animals of all classes, from insects[1] up to monkeys, perform acts which are certainly analogous to those performed by the human mind, and which ought to rank with the reason of man. Reason, we are told, is the power by means of which one proposition is deduced from another, and of forming a conclusion from known premises. Now if it could be proved that animals are possessed of feelings of love, hate, jealousy, grief, kindness, memory, and many other human traits; that they can distinguish right from wrong; if it could be proved that they are capable of drawing conclusions from known premises; and that they can and do follow out a train of reasoning; then it would be proved beyond all peradventure that they do have reason, and to a very marked degree.

There are thousands of anecdotes relating to all classes of the animal kingdom showing in a greater or less degree the reasoning faculty. It is obviously impossible to give anything like all of them here, and a few of the more striking and relating to the principal classes, will serve to point our moral and adorn our tale.

Of the Articulates, the Crustacea are considered low in the scale, yet instances showing reason are recorded of them. Darwin[2] tells us of a shore crab seen in Brazil by Mr. Gardiner. The animal was making its burrow in the sand, and Mr. G. threw some shells toward it. One of them rolled in, and three others lodged on the edge. The crab in about five minutes, brought out the shell, and carried it off about a foot and dropped it. Returning

[1] Lindsay in his "Mind in the Lower Animals" says that even in the Protozoa we find manifestations of purpose. That, in fact, all the orders of the Invertebrata are possessed of intelligence, foresight and reason to a greater or less extent. This is especially the case with ants. 1, pp. 52–68.

[2] Descent of Man, 1st ed., 1, 325.

and seeing the three other shells near the edge of his burrow, and apparently thinking that they too might roll in, he carried them off one by one, and deposited them with the other. Did not this animal reason on the subject in the same manner as a man would? Most decidely so. Hermit crabs have been seen to rob one another of their shells. A big one was once seen to give chase to a little crab with a shell much larger than his own. "The little one, apparently quite alive to the sinister intentions of his pursuer, took to flight as quickly as possible, and his attempts to escape were continued with the utmost vigor until further effort was hopeless. * * * At length he was overtaken, and then a regular pitched battle ensued. The little one resisted manfully, but was finally overcome, the more bulky opponent having, after the most strenuous exertions, succeeded in forcing his claws between the body of his weaker opponent, and his shell, and with the most frantic exertion turning him out. They then, apparently as a matter of course, exchanged shells, the ousted tenant yielding submissively to his fate, and quietly adapting himself to his reduced circumstances."[1] Suppose a man with boots too small for him, saw a little man with boots much larger than his own. Suppose society in such a state as to allow the big man to rob the little one of his boots, and leave his own for the use of the other. Would the man act by reason or by instinct? The answer is obvious.

Insects are higher than crabs in the animal creation, and among them we find the best developed instincts with a high degree of reasoning. Take for instance the ants. They live in communities, and some obey while others command; some work while others direct, so they must have a method of communicating ideas;[2] they recognize their comrades after being separated from them for months,[3] and therefore have memory; and language and memory are two of the highest gifts of man's mental nature. Bees can distinguish one kind of flower from another;[4] they bite holes in the base of the corolla to get at the honey when it is too

[1] Wood's "Man and Beast." N. Y., 8vo ed., p. 95.

[2] Sir J. Lubbock in AM. NAT., X, 156, et seq. Also note in *Pop. Sci. Mon.*, IX, p. 252. Article on "Habits of Ants" in *Pop. Science*, XI, 39.

[3] Huber, "Recherches sur les Fourmes," quoted in Kirby and Spence, l. c., II, 66. Lubbock, ibid, X, 154.

[4] Darwin, "Cross and Self Fertilization in Vegetable Kingdom," p. 416.

far for them to reach from the top, and when the hole is once bitten will always seek it;[1] thus one individual takes advantage of the labor of another. They can alter the shape of the cells of their hive to suit circumstances.[2] They are compelled to learn how to distinguish the situation of their hive when moved to a new place by circling round and round in the air and taking mental notes of its position;[3] and it is only after observation, experience and practice, that they can fly directly to the entrance. Wasps learn the position of their nests in the same manner. They are capable of being tamed and of recognizing their masters,[4] as are also butterflies. In districts where some species of dung beetles are found, they have the habit of depositing eggs in pellets made of horse or cow manure; but in districts where sheep are kept, instead of making the pellets, the insects use the pellet shaped excrement of these animals.[5] Beetles assist one another in their work and communicate ideas.[6]

If it seems unreasonable to say that an insect, without any distinct brain and nothing but a system of ganglia, can reason in such a manner, we might ask, what do you know about the mental powers of insects? How can we gauge their sight and compare it with ours, when their eyes have often hundreds of facets?[7] Or know aught of their feelings when we know that some feel with their antennæ?[8] Or anything about their hearing, when some hear with their antennæ, some with their fore legs, and some with their wings?[9] We don't know anything about it, and perhaps never will.

Many stories are told of the actions of toads. They can be easily tamed, will feed out of one's hand, and come at a call. Here is an anecdote of one. A lady was sitting in a garden,

[1] Huber, Linn. Trans., VI, 222, quoted by Kirby and Spence, l. c., II, 516. Darwin, ibid, pp. 426, et seq.

[2] Kirby and Spence, l. c., II, 475-489.

[3] Huber, Recherches, p. 100, quoted by Kirby and Spence, l. c., II, p. 520.

[4] Sir John Lubbock's tame wasp has become historical.

[5] Kirby and Spence, loc. cit., II, 469, quoted from Sturm's Deutschland's Fauna, I, 27.

[6] Kirby and Spence, loc. cit., II, 519, quoted from *Illiger's Mag.*, I, 488.

[7] "The number of facets or corneæ vary from 50 (in the ant) to 3650, the latter number being counted by Geoffroy in the eye of a butterfly." Packard, l. c., p. 25.

[8] Packard, loc. cit., p. 26.

[9] Wallace, Contributions, loc. cit., p. 202.

when she saw a large toad moving along the base of a wall, and examining it most systematically. He raised himself on his hind legs, peered into a crevice first with one eye and then with the other, and pushed his paw into the aperture. Apparently dissatisfied, he continued his operations and examined another, and then a third. This last seemed to satisfy him, and slowly drawing himself up he disappeared into the crevice. He evidently knew his own size and selected a hole big enough to crawl into without effort.[1] All fishermen know how difficult it is to induce an old trout to take the fly, and when hooked how successful he often is in tangling the line, or snapping it off against roots or stones. He has gained by long experience a knowledge of the traps set for him by man, and uses his knowledge in keeping out of the snares, and breaking away when caught. He has sense enough to know the danger he is in, and reason enough to keep out of it.

In respect to the reasoning powers of birds, there are so many anecdotes that it is difficult to make a selection. Every one knows how easily many birds are tamed; the crow or raven for instance, and above all the parrot, and how cunning they are in hiding any article they wish to keep to themselves. Swallows know that the hawk is their enemy, and sometimes take great delight in pestering him. Dashing forward as if immediately into his claws, then suddenly swerving off and enjoying the discomfiture of their enemy, who thought to have a feast. A swallow had become entangled by the leg with a string. His cries attracted some companions, and after a consultation they conceived a method of releasing the captive. They commenced to fly past the bird one after the other, each pecking at a certain point on the string as he passed, until it was cut in two, and the bird freed from bondage. A story is told of a goose and a hen. The latter hatched out some duck eggs, and of course the ducklings wished to take immediately to the water. The hen objected seriously, but without avail, and while she was mourning over the obstinacy of her brood, a solitary goose swam up, and with a noisy gabble took charge of them. After piloting them up and down for a while, they were turned over to their foster mother. Next day the same scene was repeated. This time the goose came close up to the bank, and without further parley the hen jumped on her

[1] Wood, Man and Beast, loc. cit., p. 23.

back and sailed about while the ducklings were enjoying their swim. This took place day after day, until the ducks were large enough to take care of themselves.[1] A gentleman busily at work in his garden had his attention attracted by a robin, who was acting in a curious manner. Feeling some curiosity to know what was the cause, he followed the bird and was led directly to her nest. There he saw a black snake which was in the act of robbing the nest. After the snake was killed, the bird showed great joy; flew down and pecked at the dead animal with every appearance of hatred, and then lighted on the gentleman's arm and poured forth her delight and gratitude in song.

With respect to mammals, it is hardly possible to see how any body can deny that they often reason. Who can not think of instances of the intelligence of dogs? or of a horse? or of the elephant? A very few anecdotes must here suffice. A retriever was observed by a workman busily collecting grass and leaves and carrying them in his mouth to one place. On examining the spot he found a hedgehog closely rolled up. When the dog had collected a sufficient quantity of grass to prevent the spines wounding him, he took the bunch in his mouth and trotted off. Darwin[2] tells a story of another retriever which most conclusively shows reason. "Mr. Colquhoun winged two wild ducks, which fell on the opposite side of a stream. His retriever tried to bring over both at once, but could not succeed; she then, though never before known to ruffle a feather, deliberately killed one, brought over the other, and returned for the dead bird." He also quotes Rengger in regard to American monkeys. Rengger states, "that when he first gave eggs to his monkeys, they smashed them, thus losing much of their contents; afterward they gently hit one end against some hard body and picked off the bits of shell with their fingers. After cutting themselves only once with any sharp tool, they would not touch it again, or would handle it with the greatest care. Lumps of sugar were often given them wrapped up in paper, and Rengger sometimes put a live wasp in the paper, so that in hastily unfolding it they got stung; after this had once happened, they always first held the packet to their ears to detect any movement within."[3] A baboon in London had the habit of

[1] Wood, Man and Beast, loc. cit., p. 49.

[2] Descent of Man, 1st ed., 1, p. 46.

[3] Descent of Man, 1st ed., 1, 45, 46.

adopting animals. Once a young kitten scratched him. He was astonished and looking at the kitten's paws, immediately bit off the claws. Animals, monkeys especially, use sticks and stones as instruments and weapons. A party of baboons in Africa were attacked by men at the entrance of a narrow pass in the mountains. The animals were up on the mountain side, and rolled the stones down into the pass so thick and fast that for a time it was completely blockaded. The orang in Borneo knows how to handle and throw sticks in the same manner, and even makes himself a bed in the tree to sleep at night, covering his head with leaves.[1] Humboldt refers to the horses and mules used in crossing the Andes. "Thus the mountaineers are heard to say, 'I will not give you the mule whose step is the easiest, but the one which has the most intelligence.'"[2]

It is hardly possible in the limits of an article like this, to do justice to our subject, but we are sure that what little has been said, will show to a fair and impartial reader, that animals certainly do possess a large amount of reason. There may be those who prefer to think that instincts are given to animals in a perfect form, by the Almighty. These seem to think that in taking the matter out of the Creator's hands directly, and placing all animal life under the control of natural laws, that we thereby detract from His power. But not so. For He made the laws by means of which animal life has progressed on the globe, and after the establishment of these laws, He holds Himself aloof from interfering. It is more degrading to the grandeur of the Infinite to suppose He has been compelled to interfere constantly with the works of His hands, than to suppose that He has, in the first place, established laws immutable and unchangeable, and endowed the first germs of life with the possibilities which have led to such grand results as are visible in the animal kingdom.

[1] Wallace, Malay Archipelago, N. Y. ed., p. 52, 70.

[2] Travels in Equatorial Regions of South America, I, 249.

PROGRESS OF ANTHROPOLOGY IN AMERICA DURING THE YEAR 1880.

BY PROFESSOR OTIS T. MASON.

THE definition given to anthropology in the last year's sketch, published in the NATURALIST, May, 1880, is still retained. And the restricted area of this summary must also preclude any reference to the vast body of literature which has accumulated upon this subject in all the civilized countries of Europe. By American anthropology, however, we would be understood to mean both the subjective and the objective view of the term—publications (1) upon the anthropology of the American races, wherever they may have been printed, and (2) works by American anthropologists, whatever may have been the special branch of the science upon which they wrote.

The subdivisions of anthropology are somewhat arbitrary; indeed, those adopted here represent specialists rather than sharp lines of scientific demarcation. It is very convenient, however, to group the titles of papers in the following order:

I. Anthropogeny.
II. Archæology.
III. Biology.
IV. Comparative psychology.
V. Ethnology.
VI. Linguistic anthropology.
VII. Technology.
VIII. Sociology.
IX. Religion.
X. Instrumentalities.

I. *Anthropogeny.*—The appearance in an English translation of Ernst Haeckel's "Genesis of Man," during the year 1879, marked an epoch in anthropology. No such contribution to ontogeny and phylogeny appeared in 1880, but the statements of Haeckel have been taken up in detail, examined, attacked and defended with great spirit.

American scholarship continues to occupy a very humble rank in this department of our subject, as the following titles will show:

GILL, THEODORE—(Washington, D. C.) On the Zoölogical Relations of Man. Tr. Anthrop. Soc., Washington. I, p. 15. [A résumé of the doctrine of evolution.]

HOLMES, NATHANIEL—(St. Louis, Mo.) Geological and geographical distribution of the human race. Tr. Acad. Sci., St. Louis, IV, I. [A summary.]

PARKER, DR. A. J.—On the brain of a Chimpanzee. *N. Y. Med. Record*, Jan. [An original investigation.]

WARD, LESTER F.—(Washington, D. C.) Pre-social Man. Tr. Anthrop. Soc., Washington, I, 68. [An application of the doctrines of Haeckel to the origin of intellectual and social phenomena.]

WINCHELL, ALEXANDER (Ann Arbor, Mich.)—Pre-adamites; or a demonstration of the existence of men before Adam: together with a study of their condition, antiquity, racial affinities and progressive dispersion over the earth. Chicago: S. C. Griggs & Co., 1880, I vol., pp. 500, with charts and illustrations. 8vo. [Outside of its controversial aspect, a valuable contribution to anthropology.]

II. *Archæology.*—The subject of archæology is a favorite among the divisions of anthropology in America. The Smithsonian Institution, conjointly with the National Museum, represents the country at large. In Massachusetts the Archæological Institute of America, the Peabody Museum, and the American Antiquarian Society have all made most valuable contributions to archæological knowledge. In New York city the American Museum of Natural History is making rich collections. Mr. Terry's fine private cabinet is now on exhibition there. Nothing is published by them as yet. The Philadelphia societies are not idle in the matter of archæology, although they have lost an earnest worker in Professor Haldeman. The Bureau of Ethnology at Washington, under the direction of Major J. W. Powell, while engaged more especially in the living problems of humanity, has made very exhaustive investigations relative to the Pueblos. The Anthropological Society of Washington has published its first volume of Transactions, which, although bearing date of 1881, is really a part of the work of 1880.

Proceeding westward, we find the Western Reserve Society of Cleveland, the Cincinnati Society of Natural History, the Madisonville Literary and Scientific Society doing excellent work in Ohio. The St. Louis Academy of Missouri and the Davenport Academy of Iowa are not a whit behind the older societies of the East in their zeal and efficiency. In several of the Western States, notably Indiana, Wisconsin and Minnesota, the State geological and statistical reports contain much that is valuable in archæology.

Nor is this all; private wealth is lavished upon local museums so indiscriminately, that frauds begin to multiply unpleasantly. In the discussion of instrumentalities, a catalogue of journals publishing archæological papers will be given. The following is a list of papers and works published upon the subject:

ABBOTT, C. C. (Cambridge, Mass.)—Flint Chips. Peabody Mus. Rep., II, pp. 506–520.

Aboriginal remains in the valley of the Shenandoah river. *Science*, p. 262.

AMEGHINO FLORENTINO—Armes et instruments de l'homme préhistorique des Pampas. *Rev. d'Anthrop.*, 1880, pp. 1–12.

American Antiquarian Society Proceedings, No. 75 and No. 76. [Papers by Valentini on Mexican paper and on the Landa alphabet.]

American Antiquarian. [Published by the Rev. S. D. Peet, with a corps of able assistants. Archæological papers by Babbitt, Beauchamp, Brown, Hovey, Love, Peet and Whittlesey.]

Anales del Museo Nacional de Mexico. [Papers on Mexican antiquities, by Chavero, II, 1–46, 107–126, illustr. Anales de Cuauhtitlan, appendix, pp. 1–32.

BACON, A. T.—The ruins of the Colorado valley. *Lippincott's Mag.*, Nov.

CASE, THEO. S. (Kansas City, Mo.)—An excursion to the birthplace of Montezuma. *Ks. City Rev.*, Nov. [This periodical devotes a great deal of space to archæology and other branches of anthropology.]

CHARNAY, DÉSIRÉ—The ruins of Central America. *No. Am. Rev.*, Sept., Oct., Nov., Dec., 1880. [This expedition, fitted out by Pierre Lorillard, of New York, in conjunction with the French Government, represents a phase of archæology, which may be called the Prescott School, against which Mr. Morgan and those who agree with him, are working.]

COLLETT, JOHN—"A Vincennes mound" and "The Worthington mound." Indiana Rep. of Stat. and Geol., 1880, pp. 387–396.

DAWSON, J. W. (Pres. McGill College, Montreal)—Fossil men and their modern representatives. An attempt to illustrate the character and condition of Prehistoric men in Europe by those of the American races. Montreal, Dawson Brothers, 1880. 1 vol., VIII, pp. 348, illustr., 12mo. The same author has also published "The chain of life in geological time," and "The antiquity of man and the origin of species."

FARQUHARSON, R. J. (Davenport, Iowa)—Prehistoric trephining in America, and The contemporaneous existence of man and the mastodon in America. A. A. A. S., Boston, 1880.

GANNETT, H.—Prehistoric ruins in So. Colorado. *Pop. Sci. Month.*, March.

HAINES, HENRY W.—Fossil man. *Pop. Sc. Month.*, Jan.

KERR, W. C.—The mica veins of North Carolina. Tr. Am. Inst. Min. Engineers, Feb., 1880.

LEWIS, H. C.—Antiquity of man geologically considered. *Science*, Oct. 16. See also Proc. Acad. Nat. Sc. Philad., Nov. 24, 1879, for a discussion of the antiquity of the Trenton gravels.

LOW, CHARLES F.—Archæological explorations by the Literary and Scientific Society of Madisonville, O., Part III, Jan. to June 30, 1880.

MACADAMS WILLIAM (Otterville, Ill.)—Antiquities of Western Illinois in several journals. A full list in Smithson. Rep. for 1880.

MACLEAN, J. P.—Mastodon, mammoth and man. R. Clarke & Co., Cin. See also *Universalist Quarterly*, July.

MORGAN, LEWIS H.—Description of an ancient stone pueblo on the Animas river, N. Mex, with a ground plan. Rep. Peabody Mus., II, 536–556. [In the first Report of the Archæological Institute of America, Boston, Mr. Morgan defines minutely his views with reference to the significance of the architectural features of the stone structures of Mexico and Central America.]

MORSE, EDWARD S.—The Omori Shell-heaps. *Nature*, April 15, 1880. Japanese Archæology. *Am. Naturalist*, September. Dolmens in Japan. *Pop. Sci. Month.*, March.

POTTER, W. B. and EDWARD EVERS—Contribution to the archæology of Missouri, by the Archæological Section of the St. Louis Academy. Part I. Pottery. pp. 30, 5 maps, 24 plates. 4to. [A work of great beauty and solid merit.]

RICE, A. THORNDIKE—Ruined cities of Central America. *N. A. Review*, Aug. [Introduction to M. Charnay's articles.]

SHORT, JOHN T.—The North Americans of antiquity; their origin, migrations and type of civilization considered. N. York, Harper & Brothers, 1880. 1 vol., pp. 544, illustr., 8vo.

Smithsonian Report of 1879, published in 1880. Archæological papers on Montana, P. W. Norris; Arizona, R. T. Burr; Wisconsin, Thos. Armstrong, W. G. Anderson; Iowa, Samuel B. Evans, R. N. and C. L. Dahlberg; Missouri, G. C. Brodhead; Illinois, Theron Thompson, A. Toellner, A. Oehler, Brainerd Mitchell, W. H. Adams; Indiana, Edgar R. Quick, F. Jackman; Georgia, Chas. C. Jones, Jr.; Alabama, W. Gesner; Mississippi, Jas. Hough; Louisiana, B. H. Brodnax; N. Jersey, F. D. Andrews; Florida, S. T. Walker.

Washington, Anthropological Society of—Vol. I of the Proceedings up to Dec. 31, 1880, contains archæological papers by Cushing, Mason, De Hass, Reynolds and McGuire.

WHITTLESEY, COL. CHARLES (Cleveland, O.)—Relics of aboriginal art and their ethnologic value. No. 52. W. Reserve and No. Ohio Hist. Soc., May, 1880. See also *Am. Antiquarian*, III, No. I.

WIENER, CHARLES—Pérou et Bolivie. Paris, Hachette & Co., I vol., pp. 796, 1100 cuts, 27 charts and 18 plans, gr. 8vo. [A superb work.]

III. *Biological Anthropology.* — In the division of biological anthropology are included all labors relative to man as an animal. Whether or not intellection shall be included will be left an open question. There is no doubt, however, of the great value derived to anthropology from a comparison of the human being with other living forms, from the dawn of life to the night of death. Again, anthropology was at first studied almost solely by physicians, and the number of those who attach great importance to anthropometry and structural characters in determining race, etc., is very large. Our own country, alas, is not up to the mark in this particular, and the list of authorities can soon be read over.

Anthropological Society of Washington. Papers by Dr. Swan M. Burnett on color blindness as affected by race. Vol. I, 7.

BOTELER, W. C.—Peculiarities of American Indians from a physiological and pathological standpoint. *Maryland M. J.*, Baltimore, 1880–1, VII, 54–58.

HADRA, B. E.—Mensuration of the thorax below the diaphragm. *Boston M. and S. J.*, 1880, 247–249.

HAYMOND, W. S.—Human longevity. Tr. Indiana M. Soc., Indianapolis, 1880, 73–99.

SPITZKA, E. C.—Contributions to anatomical anthropology, chiefly the encephalon. *Science*, I, pp. 73, 125, 134, 176, 202, 235, 251, 303; *J. Nerv. and Ment. Dis.*, Ap. and July, 1880, p. 106; see also *ibid*, Oct., and *St. Louis Clin. Record*, Jan., Feb., April, May, June, Aug., Sept., 1880.

YARROW, H. C.—Medical facts relating to the Zuñi Indians of N. Mexico. *Rocky Mt. M. Rev.*, Colorado Springs, 1880, 192–194.

IV. *Comparative Psychology.*—Psychical anthropology has to do with ratiocination, emotion and volition from two points of view. In the first place it is a proper subject of investigation whether the difference in the manifestation of the qualities just mentioned is one of kind or one of degree in man and the lower animals. In the language of the physicist we would know whether the difference is quantitative or qualitative also. However this may be settled, there springs up a question of vital significance to us as Americans and to all civilized nations that have uncivilized tribes to deal with. It is this: Are there psycho-racial characteristics which should be regarded in treating with various peoples? Another query might arise whether there are intellectual boundaries, mental gradations, psychic lines of promotion along which spiritual growth must take place. Whatever may be the outcome of these problems, there is no lack of activity among investigators.

Bibliograph:

Animal instinct in relation to the mind of man. *Science*, I, 267, 280.

LINDSAY, W. LAUDER—The moral sense in the lower animals. *Pop. Sc. Month.*, Feb.

PORTER, PROFESSOR SAMUEL—Is thought possible without language? Case of a deaf-mute. Tr. Anthrop. Soc., Washington, I, 74.

PREGER, W.—Psychogenesis in the human infant. *Pop. Sc. Month.*, Sept.

V. *Ethnology.* — Men are found in groups called variously, tribes, nations, races, peoples, stocks, etc. No two ethnologists agree as to the proper distinguishing marks, or to the number of the groups; yet every traveler knows that such divisions of mankind exist. A rough definition of one of these units would be a collection of human beings occupying a given territory, who recognize in one another a common bond of kinship. Physical, mental, linguistic, social and religious peculiarities are usually coördinated with territory and kinship.

The following works have appeared during 1880:

ACOSTA, J. DE—The natural and moral history of the Indies. Reprinted from the English edition by Edward Grimshaw, 1604, and edited with notes and an introduction by Cl. R. Markham. London, Hackluyt Soc., 1880, I v., pp. 295, I chart, 8vo.

BRACKETT, ALBERT S.—The Shoshones or Snake Indians; their religion, superstitions and manners. Smithson. Rep., 1879, 328.

DUNBAR, J. B. (Deposit, N. Y.)—The Pawnee Indians. *Mag. Am. Hist.*, April, Nov., 1880. See also on the decrease of the Indians. *Ks. City Rev.*, Sept.

FLOWER, W. H.—The American Races. *Brit. M. J.*, London, 1880, I, 549, 577, 616.

HAVARD, V.—French and Indian half-breeds. Smithson Rep., 1879.

ICAZBALCETA, JOAQUIN GARCIA (Mexico)—Historia de los Mexicanos por sus pinturas. An. d. Mus. Nac. de Mexico, II, 85–106.

LEGGE, WM. (Toronto)—Canada and her Indian tribes. *Canadian Month.*, Aug., 1880, p. 137–149.

LEMLY, H. R.—Among the Arrapahoes. *Harper's Mag.*, March.

Narragansett tribe of Indians. Providence, E. L. Freeman & Co., 1880. Pamph. pp. 92, 8vo.

OBER, FREDERICK A.—Camps in the Caribees. Boston, Lee & Shepard, I vol., 12mo.

PUTNAM, F. W.—The Indians of California. Bull. Essex Inst., XII, Mar. I, 1880.

REY, PHILIPPE MARIUS—Etude anthropologique sur les Botocudos. Paris, 1880.

RIALLE, GIRARD DE—Les peuples de l'Afrique et de l'Amerique. Bibliotheque Utile, Vol. IV. Paris, Balliere & Cie, 1880, pp. 184.

ROYCE, C. C.—An inquiry into the history and identity of the Shawnee Indians. Tr. Anthrop Soc., Washington, I, 94.

SHEA, JOHN GILMARY—A description of Louisiana. By Father Louis Hennepin, I.

VI. *Linguistic Anthropology.*—A linguist is not necessarily an anthropologist; indeed, a philologist, or one versed in the comparative study of language, may prosecute his researches in such a manner as to fall short of the meaning of the term. Linguistic anthropology is the study of language, first in its origin, as the medium of communicating thought, emotion and volition. In this sense animals have language. In the second place, it takes into consideration the evolution and the elaboration of language to keep pace with human progress. Thirdly, there are genera and species of language, that is to say, there are *summa genera*, or great divisions, which are separable into stocks, tongues and dialects. It is the design of the anthropologists to comprehend all the languages of the world in a vast scheme as the botanist groups his plants or the zoölogist his animal specimens. In order to accomplish this end it is necessary to become acquainted with the plan of structure of every language on earth. It is for this purpose, and not for their commercial value, that so much pains is taken in preserving the language of savages. The Bureau of Ethnology of the Smithsonian Institution, under the management of Major J. W. Powell, is devoting most of its energies to this branch of the subject. Indeed it is one of the departments of anthropology of which our country has just reason to be proud. The following works appeared in 1880:

CHARENCY, H. DE—Archéologie Americaine. Déchiffrement des écritures calculiformes ou Mayas, le bas-relief de la croix de Palenque et le manuscrit Troano. Alencon, de Broise, 1880, pp. 52, figs., 8vo.

FAY, E. A.—The testimony of the Romance languges concerning the forms of the imperfect and pluperfect subjunctive in the Roman folk-speech. Tr. Anthrop. Soc. Wash., I, 72. Reprinted in the *Am. J. of Philology.*, I, p. 411.

GATSCHET, ALBERT SAMUEL (Bureau of Ethnology, S. I., Washington, also editor of the dept. of language in the *Am. Antiquarian*)—The numeral adjectives in the Klamath language, So. Oregon. *Am. Antiq.*, II, 210–217. The Timucua language. Proc. Am. Phil. Soc., Feb. 20, 1880. Indian color names. Tr. Anthrop. Soc. of Wash., I, 10.

MALLERY, GARRICK (Bureau of Ethnology, S. I., Washington, D. C.)—Introduction to the study of sign language among the No. Am. Indians as illustrating the gesture speech of mankind. Washington, Gov. Printing Office, 1880, pp. 72, 4to.

A collection of gesture signs and signals, &c., distributed to collaborators. Same printer, pp. 329, 4to.

MASON, OTIS T.—A comparison of a written language with one that is spoken only. Tr. Anthrop. Soc. W., I, 21.

MOLINA, PADRE FR. ALONZO DE—Vocabulario de la Lengua Mexicana. Platzman ed. Leipzig, Tuebner, 1880.

OROZCO Y BERRO, MANUEL (Mexico)—Codice Mendocino. Anales del Mus. Nac. d. Mex., II, 47–82, 127–130, 205–222.

PAUSOT, J.—Note sur la langue des Taensas. *Rev. Linguistique,* Ap.

POWELL, J. W. (Chief of the Bureau of Ethnology, Washington, D. C.)—On the evolution of language. Tr. Anthrop. Soc., W., I, 35.

Introduction to the study of Indian languages. Washington, Govt. Print. Off., XI, pp. 228, 8 ruled leaves, 4 charts, 4to.

VALENTINI, PHILIPP, J. J.—The Landa alphabet. Proc. Am. Antiq. Soc., Ap. 28. 1880.

VII. *Technology.*—In looking over the whole area of human activity, one is struck with the great variety of industries which have grown up around a few necessities—for food, clothing, shelter, emotional gratification, and the means of enforcing volition. This class of investigations we exclude from Mr. Spencer's notion of sociology, including under technology his operative phenomena; and retaining sociology for the manifestation of society in the family, the guild and the state. A third class of questions will then be grouped under religion or Sebastic anthropology. Let it be borne in mind that this classification is for the convenience of investigators. The following works are noted:

BUTLER, PROFESSOR J. D.—Aboriginal use of copper in war and peace. *Am. Antiquarian*, III, No. 1.

DAHLBERG, R. N. and Charles L.—Composition of ancient pottery. Smithson Rep., 1879, 349.

GOODE, G. BROWN—The use of agricultural fertilizers by the Am. Indians. *Am. Naturalist*, July, 1880.

GORE, J. HOWARD—Tuckahoe, or Indian bread. Tr. Anthrop. Soc. W., I, 101.

HOY. P, R. (Racine, Wis.)—How were copper implements fabricated by the aborigines of this country. Wis. Histor. Collections, VIII.

KNIGHT, EDWARD H.—A study of savage weapons at the Centennial Exhibition, Philadelphia, 1876. Smithson. Rep., 1879, 213–297. [Profusely illustrated. Separately printed for distribution.]

MORGAN, LEWIS H.—A study of the houses of the American aborigines, with suggestions for the explorations of the ruins of New Mexico, Arizona, the valley of the San Juan, Yucatan and Central America. Rep. Archæol. Inst. of Am. 1879-1880.

SCHUMACHER, PAUL—The method of making pottery and baskets by the Indians of So. California. Rep. Peabody Mus., II, 521-525.

SOLLAS, W. J.—On some Eskimo bone implements from the east coast of Greenland. *J. Anthrop Inst.*, IX, 329–336.

VIII. *Sociology.*—Biography and history are records of human actions done by individuals or organized communities. Sociology is based on human actions also. The line of demarcation is here. Of any people their history would tell what they did in this or that emergency, but sociology inquires into what they were accustomed to do. The dividing line is like the sutures of the cranium, exceedingly crooked and involved, but with a little care it is not difficult to decide where history leaves off and sociology begins. The appearance of the Rev. Lorimer Fison's work on Australian marriage laws, with an introduction by Mr. Lewis H. Morgan, has been the occasion of brightening up old armor by Mr. McLennan and others who do not agree with our fellow-citizen.

BANDELIER, AD. F.—On the social organization and mode of government of the ancient Mexicans. Rep. Peabody Mus., II, 557–699.

DUNBAR, J. B.—The decrease of the North American Indians. *Kan. City Rev.*, Sept.

GORE, J. HOWARD.—The development of deliberative government among the No. Am. Indians. Tr. Anthrop. Soc. Washington, I, 58. By the same author, The old Roman Senate: a study of deliberative assemblies, *id.*, 9.

HOUGH, M. B. W.—Civilization. Tr. Anthrop. Soc. W., I, 100.

POWELL, J. W.—Wyandotte Government. A short study of tribal society. A. A. A. S., Boston. *Science*, I, No, 17; Cong. Record, Feb. 1, 1881; Tr. Anthrop. Soc. W., I, 76.

ROYCE, C. C.—The Indian title. The method and chronology of its extinction. Tr. Anthrop. Soc. W., I, 84.

YARROW, HENRY CRECY—Introduction to the study of mortuary customs among the No. Am. Indians. Washington, Gov. Print. Office.

IX. *Religion.*—Religion, in its widest sense, includes the belief in the existence of spiritual beings, together with all the paraphernalia and observances which have grown up around that belief. In this sense the anthropologist takes the term and seeks to trace its origin and history. The following works appeared in 1880:

ANDERSON, RASMUS B.—Teutonic mythology. *Am. Antiquarian*, II, No. 4. [Professor Anderson conducts the department of Pre-columbian Hist. in the *Antiquarian.*]

DORSEY, J. OWEN—The rabbit and the grasshopper: an Otoe myth. *Am. Antiquarian*, III, 1.

GATSCHET, A. S.—Superstitions. Tr. Anthrop. Soc. W., I, p. 103.
The four creations of mankind; a Tualati myth, *id.*, 60.

LUQUINS—The Avesta and the storm myth. *New Englander*, Sept.

MALLERY, GARRICK—Comparative mythology of the two Indies. Tr. Anthrop. Soc. W., I, 12.

POWELL, J. W.—Mythologic philosophy. Vice-president's address before the Am. Association at Saratoga, Vol., XXVIII.

RIGGS, STEPHEN R.—The Theogony of the Sioux. *Am. Antiquarian*, II, 4.

X. *Instrumentalities.*—Under this head we have no more to do than to enumerate the sources of information to which the student must go for his materials of study.

American Antiquarian, Rev. S. D. Peet, Clinton, Wisconsin, Ed.

American Association for the Advancement of Science, Vol. XXVIII, Saratoga Meeting.

American Naturalist, McCalla & Stavely, Philad. Papers by various authors. Notes by O. T. Mason.

Anthropological Society of Washington. J. W. Powell, Prest., C. C. Royce, Sec.

Archæological Institute of America, Boston. Edward H. Greenleaf, Sec.

BOEHMER, GEORGE H.—Index of papers on anthropology published by the Smithson. Inst. from 1847–1878. Sm. Rep., 1879 and separate.

Davenport Academy, Iowa. Proceedings. J. D. Putnam, Prest.

DAVIS, CHARLES H. S.—Index of articles on archæology, anthropology and ethnology. *Am. Antiquarian*, II, No 3, 239.

Index Medicus. A monthly classified record of the current medical literature of the world. Compiled under the supervision of Dr. John S. Billings and Dr. Robert Fletcher, Vol. II, 1880. N. Y., Leypoldt.

Index to Periodical Literature. Published by the American News Co., N. Y.

Index-Catalogue of the Library of the Surgeon-General's Office, United States Army. Authors and subjects. Vol. I. A. Berlinski with a list of abbreviations of titles of periodicals, indexed. Washington, Govt. Printing Office, 1880.

[Under the word anthropology, pages 437–444, will be found a grand collection of titles and journals. A list of abbreviations occupies pp. 1–126. Without exception this work is the most minute specimen of cataloguing in existence.]

MASON, O. T.—For Anthropological Summaries. Smithson. Rep., 1879, 428–475. *Am. Naturalist*, May, and Notes in each number from Jan.–December.

Peabody Museum, Cambridge, Mass. Twelfth and Thirteenth Annual Reports, Vol. II, Nos. 3 and 4.

Popular Science Monthly. N. York, D. Appleton & Co.

RHEES, WM. J.—Visitors' Guide to the Smithsonian Institution and the National Museum. Washington.

Saint Louis Academy of Natural Sciences, Nathaniel Holmes, Secretary.

Smithsonian Institution. Annual Report. Contributions to knowledge.

Besides these, there are innumerable sources of publication in our country of which anthropologists are willing to avail themselves, and in which they seem willing to hide their productions. All of these that have any value, however, find mention in the *Index Medicus*, or in the *Index to Periodical Literature*. Pamphlets and brochures should be sent to the editor of the Department of Anthropology in the AMERICAN NATURALIST, addressed to 1305 Q st., N. W., Washington, D. C.

——:o:——

THE MANUSCRIPT TROANO.[1]

BY PROFESSOR CYRUS THOMAS.

This manuscript was found about the year 1865 at Madrid, Spain, by the Abbe Brasseur de Bourbourg while on a visit to the Library of the Royal Historical Academy and named by him "Manuscript Troano," in honor of its possessor Don Juan de Tro y Ortolano.

So far as I am aware nothing more is known in reference to its history; we are not even informed by its last owner where or how he obtained it. In ordinary cases this would be sufficient to arouse our suspicions as to its genuineness, but in this case the work itself will dispel all such suspicions.

This work was reproduced in fac-simile by a chromo-lithographic process, by the *Commission Scientifique du Mexique* under the auspices of the French Government, Brasseur de Bourbourg being the editor.

The original is written on a strip of Maguey paper about four-

[1] Extracts from a paper now being prepared by Professor Thomas for the Bureau of Ethnology, Smithsonian Institution.

teen feet long and nine inches wide, the surface of which is covered with a white paint or varnish on which the characters and figures are painted in black, red, blue and brown. It is folded fan-like into thirty-five folds, presenting when the folds are pressed together the appearance of an ordinary octavo volume. The hieroglyphics and figures cover both sides of the paper comprising seventy pages, the writing and painting of the figures having been apparently executed, after the paper was folded, so that the folding does not interfere with the writing.

A slight examination of this manuscript is sufficient to convince any one at all familiar with Landa's characters that those used here are substantially the same, be the significations what they may. On almost every page are to be found columns of characters agreeing precisely with those given by him as reprerenting the Maya days. Are they used on account of the signification of the words they represent, as Brasseur supposed, or simply to designate days?

The determination of this point must be one important step toward ascertaining the object and contents of the work.

Another prominent feature of the manuscript is the great number of numerals or numeral characters—short straight lines and dots—found on every plate. These, together with the columns of day characters, constitute fully one half the written portion of the work; hence if we can ascertain the method in which, and the object for which, these were used, sufficient will have been learned to indicate, beyond doubt, the character of the work, and will render the task of deciphering the hieroglyphs much easier than to work at them blindly.

Assuming that the reader is familiar with what has already been written upon this subject, I will at once proceed with what I believe to be the correct explanation of the use of these two classes of characters in this manuscript, and which I believe is the key that will ultimately unlock its mysteries.

As I shall have occasion to refer very frequently to the Maya calendar, and cannot, without occupying too much space, give here a full explanation of it, I refer the reader to the following easily accessible works: "Bancroft's Native Races," Vol. II, and Dr. Valentini's article in the Proceedings American Antiquarian Society, giving here only the following brief summary:

TABLE I.

Nos.	No. of Maya Days.
1	Kan
2	Chicchan
3	Cimi
4	Manik
5	Lamat
6	Muluc
7	Oc
8	Chuen
9	Eb
10	Ben
11	Ix
12	Men
13	Cib
1	Caban
2	Ezanab
3	Cauac
4	Ahau
5	Ymix
6	Ik
7	Akbal

Their year consisted of eighteen months of twenty days each, and five intercalated or added days at the end. These added days—to make the full number, 365—were not counted in any of the months, as the month never counted more or less than twenty days. The names of these twenty days are given in the annexed table. Although they were sometimes numbered from 1 to 20, yet the usual method, especially in computations of time relating to religious feasts and ceremonies, was as shown in the table. Commencing with 1 they were numbered to 13, the following day instead of being 14 was numbered 1, the next 2, and so on to 13. As will be seen from the table, supposing it to represent the first month, the second month would begin with 8 Kan, and so on through the year as shown in the following table of the months and days:

TABLE II.

Names of the Months.	Pop	Uo	Zip	Tzoz	Tzec	Xul	Yaxkin	Mol	Chen	Yax	Zac	Ceh	Mac	Kankin	Muan	Pax	Kayeb	Cumhu	Numbers of the Days of the Month.
Numbers of the Months.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Names of Days.																			
Kan	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	1
Chicchan	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	2
Cimi	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	3
Manik	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	4
Lamat	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	5
Muluc	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	6
Oc	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	7
Chuen	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	8
Eb	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	9
Ben	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	10
Ix	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	11
Men	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	12
Cib	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	13
Caban	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	14
Ezanab	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	15
Cauac	3	10	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	16
Ahau	4	11	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	17
Ymix	5	12	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	18
Ik	6	13	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	19
Akbal	7	1	8	2	9	3	10	4	11	5	12	6	13	7	1	8	2	9	20

Intercalated Days.		
	Kan	10
	Chicchan	11
	Cimi	12
	Manik	13
	Lamat	1

If the first day of the year was Kan, as in this table, then each month would commence with Kan and end with Akbal, though numbered differently. If the last day of the 18th month was 9 Akbal, as shown in this table, the five added days would be 10 Kan, 11 Chicchan, 12 Cimi, 13 Manik and 1 Lamat; the first day of the next year would be 2 Muluc.

When the year began with 2 Muluc, the last day of the 18th month would be 10 Lamat and the five added days would be 11 Muluc, 12 Oc, 13 Chuen, 1 Eb and 2 Ben. The next year would then begin with 3 Ix. Following out this process we shall find the years commencing as follows: 1 Kan, 2 Muluc, 3 Ix, 4 Cauac, 5 Kan, 6 Muluc, 7 Ix, 8 Cauac, 9 Kan, 10 Muluc, 11 Ix, 12 Cauac, 13 Kan, 1 Muluc, 2 Ix and so on, the first day being in all cases one of these four. As 13 is a prime number it will require a cycle of 52 years—13 × 4—before we again reach 1 Kan. I give here a table of one of these cycles, showing the order of the years for this length of time. The names by which the years of the different columns are designated are given at the head of the columns.

TABLE III.

Kan.	Muluc.	Ix.	Cauac.
1	2	3	4
5	6	7	8
9	10	11	12
13	1	2	3
4	5	6	7
8	9	10	11
12	13	1	2
3	4	5	6
7	8	9	10
11	12	13	1
2	3	4	5
6	7	8	9
10	11	12	13

Although their system was somewhat complicated by this singular method of numbering the days and years, still it is not difficult to understand it so far. But in order to further complicate this calendar, which was undoubtedly devised by the priests as Landa truly says, "to deceive this simple people," another period called the Katun or Ahau was introduced. This period, according to most authorities, consisted of twenty years, but according to Perez of twenty-four. Instead of being numbered in regular order, one, two, three, &c., these periods were also numbered by the thirteen series, but in the following singular order: 13, 11, 9, 7, 5, 3, 1, 12, 10, 8, 6, 4, 2, the 13th Katun preceding the 11th, and so on.

The chief difficulty experienced in attempting to bring this period into harmony with the system so far as given, is, 1st. The uncertainty as to whether it consisted of 20 or 24 years; 2d. To place these periods in their proper positions in the great cycle, that is, to determine what year in any cycle was the *first* year of a Katun. If this can be done, then it is not difficult to compare the years of the Maya calendar with those dated from the Christian era, if any one can be determined.

The reader will observe that we have so far proceeded upon the assumption that the first year of the cycle was 1 Kan, or in other words, that the Kan column always occupied the extreme left. That the four days, Kan, Muluc, Ix, Cauac—or "year bearers," as they were called by the Mayas—must follow in the order given, is manifest, but that Kan must come first does not follow from anything apparent in the system itself; either day may be the first, without any change in the system, but not without a difference in the result. There are some reasons apparent in the manuscript itself for believing that the author considered Cauac the first, or ruling day, and hence Kan the second, Muluc the third and Ix the fourth. One of these reasons will be given hereafter.

The importance of knowing which one of these days came first will be apparent from the following illustration: A certain event, for example, is dated a particular day in the year, 1 Ix. By reference to the tables we give here—one commencing with Kan and the other with Cauac—we see that if the former be the correct one, the year 1 Ix would be the 27th year of the cycle (it is marked with a star); if the latter, it would be the 40th, or 13 years later.

TABLE IV.

Kan.	Muluc.	Ix.	Cauac.
1	2	3	4
5	6	7	8
9	10	11	12
13	1	2	3
4	5	6	7
8	9	10	11
12	13	1*	2
3	4	5	6
7	8	9	10
11	12	13	1
2	3	4	5
6	7	8	9
10	11	12	13

TABLE V.

Cauac.	Kan.	Muluc.	Ix.
1	2	3	4
5	6	7	8
9	10	11	12
13	1	2	3
4	5	6	7
8	9	10	11
12	13	1	2
3	4	5	6
7	8	9	10
11	12	13	1*
2	3	4	5
6	7	8	9
10	11	12	13

As we shall have to refer very frequently to the calendar, it becomes necessary that we construct one. Since the system admits of fifty-two changes in the day on which the year begins, it would require fifty-two calendars to include the years of one cycle, just as fourteen are required to suit all the years of our system—seven for the ordinary and seven for the leap years.

As it would require much time and space to write these out in full, I have adopted the expedient shown in the following table of abbreviating the work :

TABLE VI.

A CONDENSED MAYA CALENDAR.

Cauac Column.	Kan Column.	Muluc Column.	Ix Column.	1 14	2 15	3 16	4 17	5 18	6	7	8	9	10	11	12	13	Numbers of the Months. / Days of Month.
Cauac	Kan	Muluc	Ix	1	8	2	9	3	10	4	11	5	12	6	13	7	1
Ahau	Chicchan	Oc	Men	2	9	3	10	4	11	5	12	6	13	7	1	8	2
Ymix	Cimi	Chuen	Cib	3	10	4	11	5	12	6	13	7	1	8	2	9	3
Ik	Manik	Eb	Caban	4	11	5	12	6	13	7	1	8	2	9	3	10	4
Akbal	Lamat	Ben	Ezanab	5	12	6	13	7	1	8	2	9	3	10	4	11	5
Kan	Muluc	Ix	Cauac	6	13	7	1	8	2	9	3	10	4	11	5	12	6
Chicchan	Oc	Men	Ahau	7	1	8	2	9	3	10	4	11	5	12	6	13	7
Cimi	Chuen	Cib	Ymix	8	2	9	3	10	4	11	5	12	6	13	7	1	8
Manik	Eb	Caban	Ik	9	3	10	4	11	5	12	6	13	7	1	8	2	9
Lamat	Ben	Ezanab	Akbal	10	4	11	5	12	6	13	7	1	8	2	9	3	10
Muluc	Ix	Cauac	Kan	11	5	12	6	13	7	1	8	2	9	3	10	4	11
Oc	Man	Ahau	Chicchan	12	6	13	7	1	8	2	9	3	10	4	11	5	12
Chuen	Cib	Ymix	Cimi	13	7	1	8	2	9	3	10	4	11	5	12	6	13
Eb	Caban	Ik	Manik	1	8	2	9	3	10	4	11	5	12	6	13	7	14
Ben	Ezanab	Akbal	Lamat	2	9	3	10	4	11	5	12	6	13	7	1	8	15
Ix	Cauac	Kan	Muluc	3	10	4	11	5	12	6	13	7	1	8	2	9	16
Men	Ahau	Chicchan	Oc	4	11	5	12	6	13	7	1	8	2	9	3	10	17
Cib	Ymix	Cimi	Chuen	5	12	6	13	7	1	8	2	9	3	10	4	11	18
Caban	Ik	Manik	Eb	6	13	7	1	8	2	9	3	10	4	11	5	12	19
Ezanab	Akbal	Lamat	Ben	7	1	8	2	9	3	10	4	11	5	12	6	13	20

As each of the four days (the year bearers) can have but thirteen different numbers, it is unnecessary for us to have more than thirteen columns of numbers; when we reach the thirteenth column, or month, we have passed through all possible changes of numbers, and the fourteenth month begins with one as did the first. Instead, therefore, of having eighteen columns in our table, we need to extend it only so as to include thirteen, as we can use the first, second, third, fourth and fifth respectively for the fourteenth, fifteenth, sixteenth, seventeenth and eighteenth months, as indicated by the numbers of the months which we have placed above the table.

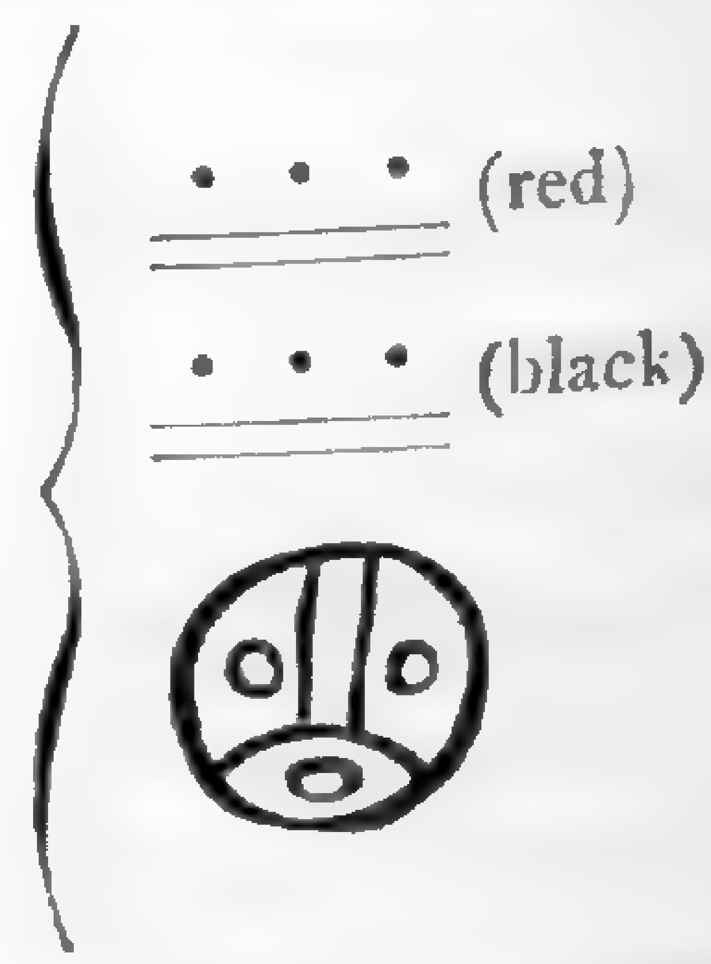
The reader must bear in mind the fact that although we have numbered the months as commencing with the left hand column, which has 1 for its upper figure; yet this holds good only when the year is 1 Cauac, 1 Kan, 1 Muluc or 1 Ix, and for none of the other years. The first month of the year may be any one of the thirteen columns, thus, 8 Cauac, 8 Kan, 8 Muluc and 8 Ix have the second column—which has 8 as its top figure—as their first month, then the one with 2 at top will be the second month, and so on to the thirteenth (7 at top) which will be the 12th month. Then we go back to the first column (1 at top) for the 13 month, and so on to the one with 10 at top for the 18th month. As the months always retain the same order and numbers, by knowing the column with which the year begins, we can, by counting in this way, find any month for any possible year. We must here warn the reader against confounding the *days of month* with the *days of the week*, the latter being the ones by which the days are usually designated; we must also warn him against confounding the *numbers of the months* with the *top numbers of the columns*. I will now show how this table is to be used by giving one or two examples:

Given the day 8 Ahau and the year 11 Kan to find the month and *day of the month*. As the year is 11 *Kan*, we must look to the Kan column. By running our eyes down this column we find that Ahau is the 17th day; then by looking along the 17th transverse line we find the figure 8 to be in the column which has 5 at the top, which we find is the second (always counting both) from the column with 11 at top; hence 8 Ahau of the year 11 Kan is the 17th day of the 2d month.

In the same way we find that 8 Ahau of the year 11 Muluc is the 12th day of the 12th month, but in this case we have to count the columns from the one having 11 at top (always inclusive) to the right through to the thirteenth (the one with 7 at top), and then go back to the first and count up to the one in which we find 8 in the twelfth transverse line.

In the Perez manuscript, translated by Stephens and published in his "Yucatan," Vol. II, we find it stated that one Ajpula died "in the year 4 Kan, the 18th day of the month Zip on 9 Ymix." The year 4 Kan begins with the column of our table which has 4 as its top figure; the third month (Zip) will then be the one with 5 at the top; running down this to the eighteenth transverse line, we find the figure 9, we also find that the 18th day of the Kan column is Ymix, agreeing exactly with the date given.

In the Manuscript Troano we find another method of giving dates, which is very common throughout the work, thus:



This, according to my interpretation, signifies 13 Ahau of the 13th month. As neither the year nor the day of the month is given, it is evident that we may find four dates satisfying the demand. Turning to our table we commence with the Ahau in the Cauac column, which we find is the second day of the month. The 13 in the second transverse we find in the column having 11 at the top; by counting *back* thirteen months (always including the one counted from and to) we find that the first month of the year is the one with 6 at the top, hence the year is 6 Cauac. The backward counting is exactly the reverse of the forward counting—count toward the left until the first column is reached, then return to the thirteenth and so on until the number of the month required is reached.

Proceeding in the same way with the Ahau in the Kan, Muluc and Ix columns, we find the years to be 4 Kan, 9 Muluc and 1 Ix.

We are now prepared to discuss the question as to whether the numerals and day characters are used in the manuscript simply as dates or not.

By counting, I find there are about 235 recognizable columns of day characters in the work, eight-ninths of which contain five characters each. Why this number? If, as I suppose, and as above illustrated, each has four dates (four different years) this gives to each of these columns twenty years ($4 \times 5 = 20$), or one Katun, for even according to the theory of Perez, four years of his period were not generally counted.

But before testing this suggestion, I wish to call attention to a certain regularity in the order of the days in these columns. The left hand column of the middle division of Plate x is composed of characters representing the following days (always reading from the top downwards) in the order here given: Oc, Cib, Ik, Lamat, Ix. If we turn to the list of days and count from one of these names to the other, we shall find in each case an interval of six days. The other column, same plate and division, contains the characters for Ahau, Cimi, Eb, Ezanab and Kan, with an interval of six days between each two. The column in the middle division of Plate VI shows an interval of five days between each two; the columns on Plate XVII, of twelve days; a column on Plate XXXI, of sixteen days; but the usual interval is either six or twelve days.

Although the interval is usually the same throughout a column, there are occasional departures from this rule, for example, in the left hand column of the upper division of Plate XIII, they are 6, 6, 4 and 2 days.

This fact, which is a marked characteristic of the work, is sufficient to show, beyond a reasonable doubt, that the days are here used simply as dates, and not for the signification of the words, as Brasseur supposed.

I understand that Charency has noticed a regularity in the order of the days, but as I have had no opportunity of examining his work, I am unable to state whether it is the fact here mentioned or not.

By examining Plates XX–XXIII, we see such a strong resemblance between them that we are forced to believe they relate to one and the same subject; the left hand column of each, which extends the whole length of the plate, is the repetition of a single day character with red numerals over each character. In Plate XXIII the character repeated is Cauac, one of the year bearers; the numerals over them are as follows, and in the following order (reading from the top downwards): 10, 1, 5, 9, 13, 4, 8, 12, (?), 7, (?), 2, 6—two of them being obliterated.

Turning to Plate XXII we find the character for Kan repeated in the same way with the numerals over them as follows: 11, 2, 6, 10, 1, 5, 9, (?), 4, 8, 12, 3, 7, 11.

On Plate XXI the character for Muluc is similarly repeated, and the numerals are 12, 3, 6, 10, 1, 5, 9, 13, 4, 8, 2, 7, 3.

On Plate XX Ix is similarly repeated, and here the numerals are 13, (?), 8, 12, 3, 7, 11, 2, 6, 10, 1, 5, 9.

If we construct a table of years for two cycles, and compare these numbers with those in the table, we shall find the two precisely the same and in the same order, except the Muluc column which presents a partial variation which I will endeavor presently to explain. We give both Cauac and Kan tables.

TABLE VII.

Cauac.	Kan.	Muluc.	Ix.
1	2	3	4
5	6	7	8
9	10	11	12
13	1	2	3
4	5	6	7
8	9	10	11
12	13	1	2
3	4	5	6
7	8	9	10
11	12	13	1
2	3	4	5
6	7	8	9
10	11	12	13
1	2	3	4
5	6	7	8
9	10	11	12
13	1	2	3
4	5	6	7
8	9	10	11
12	13	1	2
3	4	5	6
7	8	9	10
11	12	13	1
2	3	4	5
6	7	8	9
10	11	12	13

TABLE VIII.

Kan.	Muluc.	Ix.	Cauac.
1	2	3	4
5	6	7	8
9	10	11	12
13	1	2	3
4	5	6	7
8	9	10	11
12	13	1	2
3	4	5	6
7	8	9	10
11	12	13	1
2	3	4	5
6	7	8	9
10	11	12	13
1	2	3	4
5	6	7	8
9	10	11	12
13	1	2	3
4	5	6	7
8	9	10	11
12	13	1	2
3	4	5	6
7	8	9	10
11	12	13	1
2	3	4	5
6	7	8	9
10	11	12	13

If we run our eyes down the Cauac column of either table until we reach 10, we shall find the numbers from thence downwards as follows: 10, 1, 5, 9, 13, 4, 8, 12, 3, 7, 11, 2, 6, precisely as in Plate XXIII. The same thing is true in reference to the Kan and Ix columns.

The numbers on Plate XXI (Muluc) after the first two—12 and 3—skip to 6 and continue regularly from thence to 8. If we start with 12, we find the next to be 3 as given, the next is 6 instead of 7, as it should be; we notice that in the adjoining Kan column the next figure is 6, and the numbers thence to 8 as given. May we not suppose that the author of the manuscript had a similar table (with numeral characters) before him, and that in copying his eye fell on the wrong column? That such tables were used by them is rendered probable by the following quotation which Perez makes from an ancient manuscript in his possession:

"There was another number which they called *Ua Katun* and which served them as a key to find the Katunes; according to the order of its march it falls on the *Uayeb haab*, and revolves to the end of certain years, Katunes 13, 9, 5, 1, 10, 6, 2, 11, 7, 3, 12, 8, 4." By commencing at the bottom of either column of our table of years, and running up, we will find precisely these numbers, and in the order here given. It is scarcely possible these could have been obtained except by a table of years similar to those we have given. Be this as it may, the fact that these numerals and characters, as here interpreted, include a continuous period, is too plain to be ignored. The agreement in so many numbers and the order in which they come cannot be accidental.

From this we are justified in concluding, 1st. That these day characters are used simply to represent days; 2d. That the red numerals are used to denote the days or years of the Maya "week" (as their period of 13 days and years has been termed, though they applied no name to it), which is corroborated by the fact that with the exception of two on the title page, none in the manuscript denote a greater number than 13 (there is one other apparent exception, but the additional dot is a blotch or evident mistake); 3d. That the day columns are to be read from the top downwards; 4th. That Landa's characters for the Maya days are correct; and 5th. That the work is some kind of a calendar, probably containing directions to be followed by the priests and people in reference to their religious duties. Now let us apply our theory to the day columns and numerals found in some of the other plates.

We select as our first example the column in the lower division of Plate XXVI, as here both the red and black numerals are 13 throughout. The day characters are those for Ahau, Eb, Kan, Cib and Lamat, in the order here given. According to the interpretation suggested, the red numerals refer to the days of the week and the black to the days of the month. Proceeding upon this assumption, we will now try to find out, by using these numbers, in what years 13 Ahau, 13 Eb, 13 Kan, 13 Cib and 13 Lamat are to be found in the 13th month. The result is as follows:

	13 Ahau.	*13 Eb.*	*13 Kan.*	*13 Cib.*	*13 Lamat.*
Years....	6 Cauac	7 Cauac	2 Cauac	3 Cauac	11 Cauac
"	4 Kan	12 Kan	7 Kan	8 Kan	3 Kan
"	9 Muluc	4 Muluc	5 Muluc	13 Muluc	1 Muluc
"	1 Ix	2 Ix	10 Ix	5 Ix	6 Ix

TABLE IX.

Cauac.	Kan.	Muluc.	Ix.
10	11	12	13
1	2	3	4
5	6	7	8
9	10	11	12
13	1	2	3
4	5	6	7
8	9	10	11
12	13	1	2
3	4	5	6
7	8	9	10
11	12	13	1
2	3	4	5
6	7	8	9
10	11	12	13
1	2	3	4
5	6	7	8
9	10	11	12
13	1	2	3
4	5	6	7
8	9	10	11

In order to bring clearly before the eye the places in the cycle where these years fall, we give here the Cauac table governing the period embraced in the four plates heretofore alluded to. Marking the numbers, we find a continuous period of twenty years, possibly one Katun, though not in the precise order we would expect it, that is, it does not include five complete transverse lines. If we use the Kan table, we obtain the same result, except that then we shall have three years in the uppermost line and but one in the lowest. The years of this period are surrounded by a continuous dark line.

As Plate XXVII appears to be a continuation of the same subject as that presented on Plate XXVI, we select the day column of the upper division. The days are 11 Ahau, 11 Eb, 11 Kan, 11 Cib and 11 Lamat—the months all the 13th. This gives us the following years:

	11 Ahau.	*11 Eb.*	*11 Kan.*	*11 Cib.*	*11 Lamat.*
Years....	4 Cauac	5 Cauac	13 Cauac	1 Cauac	9 Cauac
"	2 Kan	10 Kan	5 Kan	6 Kan	1 Kan
"	7 Muluc	2 Muluc	3 Muluc	11 Muluc	12 Muluc
"	12 Ix	13 Ix	8 Ix	3 Ix	4 Ix

The numbers which are surrounded in the table by a waved line, also form, as we see, a continuous period of twenty years. We likewise observe that between the periods there is an interval of four years.

Plates VII, VIII, IX and X, of the second part of the manuscript furnish perhaps the strongest proof of the correctness of my interpretation of the red numerals. The middle division of these plates evidently refers to one subject. Here we find thirteen short columns, of three day characters each, inserted in the text, each character with red numerals over it, and each column with black numerals at the bottom denoting 17, as the month. We give here the names of the days with the number of each as shown by the red numerals; the order in which the columns occur is also preserved although we have strong doubts as to the correctness of Brasseur's paging.

6 Cib	13 Cib	4 Cib	11 Cib	5 Cib	12 Cib	2 Cib
7 Caban	1 Caban	5 Caban	12 Caban	6 Caban	13 Caban	3 Caban
8 Ezanab	2 Ezanab	6 Ezanab	13 Ezanab	7 Ezanab	1 Ezanab	4 Ezanab

9 Cib	3 Cib	10 Cib	7 Cib	1 Cib	8 Cib
10 Caban	4 Caban	11 Caban	8 Caban	2 Caban	9 Caban
11 Ezanab	5 Ezanab	12 Ezanab	9 Ezanab	3 Ezanab	10 Ezanab

We see by examining the list of days in the Table No. II, that these three days follow each other in the order here given, thus: if the first is 6 Cib, the next is 7 Caban and the next 8 Ezanab. It follows, therefore, that the three days of any one of these groups must fall in the same month[1] and year, hence we have to search for but four years for each column—but $4 \times 13 = 52$ years, an entire cycle. As the three numbers in a group will sufficiently designate the group, we will omit the names.

	Years.	*Years.*	*Years.*	*Years.*
6, 7, 8........	7 Cauac	12 Kan	4 Muluc	9 Ix
13, 1, 2........	1 "	6 "	11 "	3 "
4, 5, 6........	5 "	10 "	2 "	7 "
11, 12, 13........	12 "	4 "	9 "	1 "
5, 6, 7........	6 "	11 "	3 "	8 "
12, 13, 1........	13 "	5 "	10 "	2 "
2, 3, 4........	3 "	8 "	13 "	5 "
9, 10, 11........	10 "	2 "	7 "	12 "
3, 4, 5........	4 "	9 "	1 "	6 "
10, 11, 12........	11 "	3 "	8 "	13 "
7, 8, 9........	8 "	13 "	5 "	10 "
1, 2, 3........	2 "	7 "	12 "	4 "
8, 9, 10........	9 "	1 "	6 "	11 "

TABLE X.

Canac.	Kan.	Muluc.	Ix.
10	11	12	13
1*	2*	3*	4*
5*	6*	7*	8*
9*	10*	11*	12*
13*	1*	2*	3*
4*	5*	6*	7*
8*	9*	10*	11*
12*	13*	1*	2*
3*	4*	5*	6*
7*	8*	9*	10*
11*	12*	13*	1*
2*	3*	4*	5*
6*	7*	8*	9*
10*	11*	12*	13*
1	2	3	4

If we mark in the table the numbers corresponding with these years, we find that they make one complete cycle, neither more nor less. It is true we should find the same result, no matter where we begin in the cycle, but the point insisted on is, that they form a continuous term corresponding with one of the Maya periods.

We give one more example. In the second division of Plates XXX and XXXI commencing on the left half of the former and continuing through the latter, we find a series of similar figures, except the

[1] It is not necessary as a matter of course, that three successive days always fall in the same month, but in this case they do. In the Dresden codex plates 51–58, we find similar three day columns, some of which do not conform to this rule.

one on the right of the first plate, which is the god Tlaloc, or Maya equivalent. Over each figure are red numerals differing in number, and in front black numerals all denoting 11. The red numerals are (?) 9, 7, 5, 3. The first is obliterated, but judging from the space, is 1, but by the succession, is 11; however, as the result will be the same except as to the position of the period in the table, it does not make any material difference for present purposes, which we select. For reasons not necessary to be discussed here, notwithstanding the strong evidence afforded by the succession of numbers, we are inclined to believe the missing number was 1, and that the order was 9, 1, 3, 5, 7. The days found at the left of the compartment on Plate XXXI, are Kan, Cib, Lamat, Ahau, Eb; as each numeral applies to each day, the number of years indicated will be $5 \times 5 \times 4 = 100$, and will be as follows, the month being the 11th in each case:

	9 Kan.	*9 Cib.*	*9 Lamat.*	*9 Ahau.*	*9 Eb.*
Years....	12 Cauac	13 Cauac	8 Cauac	3 Cauac	4 Cauac
"	4 Kan	5 Kan	13 Kan	1 Kan	9 Kan
"	2 Muluc	10 Muluc	11 Muluc	6 Muluc	1 Muluc
"	7 Ix	2 Ix	3 Ix	11 Ix	12 Ix
	7 Kan.	*7 Cib.*	*7 Lamat.*	*7 Ahau.*	*7 Eb.*
Years....	10 Cauac	11 Cauac	6 Cauac	1 Cauac	2 Cauac
"	2 Kan	3 Kan	11 Kan	12 Kan	7 Kan
"	13 Muluc	8 Muluc	9 Muluc	4 Muluc	12 Muluc
"	5 Ix	13 Ix	1 Ix	9 Ix	10 Ix
	5 Kan.	*5 Cib.*	*5 Lamat.*	*5 Ahau.*	*5 Eb.*
Years....	8 Cauac	9 Cauac	4 Cauac	12 Cauac	13 Cauac
"	13 Kan	1 Kan	9 Kan	10 Kan	5 Kan
"	11 Muluc	6 Muluc	7 Muluc	2 Muluc	10 Muluc
"	3 Ix	11 Ix	12 Ix	7 Ix	8 Ix
	3 Kan.	*3 Cib.*	*3 Lamat.*	*3 Ahau.*	*3 Eb.*
Years....	6 Cauac	7 Cauac	2 Cauac	10 Cauac	11 Cauac
"	11 Kan	12 Kan	7 Kan	8 Kan	3 Kan
"	9 Muluc	4 Muluc	5 Muluc	13 Muluc	8 Muluc
"	1 Ix	9 Ix	10 Ix	5 Ix	6 Ix
	1 Kan.	*1 Cib.*	*1 Lamat.*	*1 Ahau.*	*1 Eb.*
Years....	4 Cauac	5 Cauac	13 Cauac	8 Cauac	9 Cauac
"	9 Kan	10 Kan	5 Kan	6 Kan	1 Kan
"	7 Muluc	2 Muluc	3 Muluc	11 Muluc	6 Muluc
"	12 Ix	7 Ix	8 Ix	3 Ix	4 Ix

We give here a table running through four cycles, on which we mark the five periods indicated by the preceding list. Each, as a matter of course, embraces twenty years, but we observe between each period four uncounted years. We must not presume from this that these years are never counted, as this is contradicted not only by the preceding example but by others which might be presented; still it does indicate that the view maintained by Perez was correct. Assuming that a Katun consisted of twenty-four years, we can see from this table why they were numbered in the peculiar manner heretofore mentioned. We see that the years with which the five, here marked, begin, are 11, 9, 7, 5, 3, in other words this order necessarily follows if the Katun or Ahau (we prefer the name Katun) consists of 24 years. If the upper and lower dark lines are extended across so as to include the whole 24 years, the periods will then commence with the years 9, 7, 5, 3, 1, and will, as I believe, give us the correct numbers of these Ahaues.

TABLE XI.

Cauac.	Kan.	Muluc.	Ix.				
1	2	3	4	1	2	3*	4*
5	6	7	8	5*	6*	7*	8*
9	10	11*	12*	9*	10*	11*	12*
13*	1*	2*	3*	13*	1*	2*	3*
4*	5*	6*	7*	4*	5*	6*	7*
8*	9*	10*	11*	8*	9*	10	11
12*	13*	1*	2*	12	13	1	2
3*	4*	5	6	3	4	5	6
7	8	9*	10*	7	8	9	10
11*	12*	13*	1*	11	12	13	1
2*	3*	4*	5*	2	3	4	5
6*	7*	8*	9*	6	7	8	9
10*	11*	12*	13*	10	11	12	13
1*	2*	3	4	1	2	3	4
5	6	7*	8*	5	6	7	8
9*	10*	11*	12*	9	10	11	12
13*	1*	2*	3*	13	1	2	3
4*	5*	6*	7*	4	5	6	7
8*	9*	10*	11*	8	9	10	11
12*	13*	1	2	12	13	1	2
3	4	5*	6*	3	4	5	6
7*	8*	9*	10*	7	8	9	10
11*	12*	13*	1*	11	12	13	1
2*	3*	4*	5*	2	3	4	5
6*	7*	8*	9*	6	7	8	9
10*	11*	12	13	10	11	12	13

Our space will not permit us to give further examples or to discuss further the meaning and use of the numerals. But before closing we would ask the reader to turn again to our table No. VII. showing the period indicated by the characters on Plates XX—XXIII. As we see, this embraces part of two cycles, and includes parts of at least three Katuns. If I am correct, it will then include a period of time which was considered notable by that people. If we turn to Plate XXXIII, where Cauac is the ruling character, we find, as I think, in the figures of the upper compartment, and in its ground-color, which is of a brownish or twilight tint, indications of the close of some important period of time. We see Ahau with a fiery red face sinking out of sight in the lower, left-hand corner, casting back, as represented by the torch in his hand, his fiery beams as he sinks below the western horizon. We say "sinks below," because, just above is another (headless) figure on which is the character Caban or Cab which signifies "to descend," and the machete. The dark figure to the right drops ten white balls, to the last or upper of which he points one finger; while just above it we see a single dark one, with a slender streak of light in it, just leaving the hand. If we cast our eyes over the Cauac column of the tables we see that *ten*, of the first cycle, is followed by *one*, of the second. This 10 corresponds with the 10 Cauac year in the next to the last group in Table XI. To the left, and directly in front of the face of the dark figure, are two characters connected, the lower one Cauac, the upper a rather unusual form of Ix. We have in this a symbol of the meeting of the two periods, the one ending with 13 Ix the other commencing with 1 Cauac.

The most conspicuous object in the compartment is the bright blue figure in the upper left-hand corner, on a black ground, surrounded by a white bordering which is crossed by dotted rays, each ending with a small round character. By counting, we find there are just twenty-three of these rays, but exactly where the dagger crosses to the eye, is a space for one more—the 24th. One year more will complete the Ahau and then its light will go out forever.

If we notice the single red dot over the second Canac character in the left-hand column of this Plate (XXIII), we observe that it is surrounded by a circle of dots, indicating its importance in some respect.

We might go on to show that the figures in the upper compartments of the four Plates XX—XXIII all relate to the close or commencement of some important period, but our limits will not permit of this, moreover our only object in presenting the foregoing is to call attention to the evidence of the following conclusions:

1st, That the work is a religious calendar of some kind; 2d, that the day characters are used for the purpose of designating the days and not for the significations for the words; 3d, that Landa's characters for the days are at least substantially correct; 4th, that the columns composed of these characters are to be read from the top downwards; 5th, that the red numerals refer to the days or years of the week; and 6th, that the black numerals in connection with the day characters, as well as those in the spaces usually refer to the numbers of the month. There are some apparant exceptions, but I have ascertained, as I can show, that these are only apparent and not real exceptions. I may also add that we have in what has been shown strong evidence that Perez was right in asserting that the Ahau consisted of 24 years.

I have succeeded in deciphering a number of the hieroglyphics of the text but will not enter upon an explanation of these at present, as I have only commenced this part of the work.

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EDITORS' TABLE.

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

The recent attempt on the life of the President of the United States naturally leads to reflections on the mental condition of the author of the crime. It is profitable to look into the question involved in the words insanity and responsibility, as expressed in terms of mental science.

The clearest classification of the mental faculties arranges them under the three heads of the affections or emotions, the intellect, and the will. It is held that through the mutual actions of the qualities of these three divisions, the acts, ordinary and extraordinary, are produced. The affections include the tastes or tendencies of the individual, which determine primarily the general direction of conduct. The intelligence furnishes the mode and means of execution, besides directing the affections through the light it throws on ends, as well as means. For those who do not believe that the doctrine of the directive power of the strongest inducement, covers the whole ground, the will is supposed to choose between the motives offered by the two classes of faculties first named.

Experience shows that the mind may be disordered in one of these departments and not in another, or in only one, sometimes a very subordinate, subdivision of either one of them. Emotional insanity may coëxist with unimpaired intelligence, and *vice-versa;* but when one class of faculties is involved, it is usual for the other to be more or less affected. So closely are they interwoven in practice, that it is not easy to unravel the insane thread from the fabric of the actions, and assert that the disorder is located in this or that region of the mental machine. To do this successfully is one of the future possibilities of a completed metaphysics.

The history of Guiteau, as reported in the daily papers, clearly indicates affectional disorder. He is evidently a person more or less insensible to the ordinary feelings of benevolence, and sympathy with his kind. His general dishonesty in questions of property, is also in evidence. The manner of his matrimonial ventures indicates the same. His regardlessness of the opinion of his fellow-men is an indication of affectional deficiency. Ingenuity and ability in the execution of his preferences, indicate that a part at least of his rational faculties are sound. Guiteau is however subject to the control of what is termed "the fixed idea," which is probably at root an emotional disorder, though it has the appearance of disease of the power of ratiocination. The mind becomes possessed of an idea to which it clings in spite of powerful counter-inducements, whether arising from the part of reason or feeling. This is probably because of some peculiar pleasure experienced in its possession. Excessive feeling controlling reason, is its usual phase, but it may sometimes be due to a defect of reason alone in some particular. In that case, however, there must be less of energy and tenacity in the idea. If Guiteau correctly represents himself, the enthusiasm for the performance of a great deed to benefit a great country, and destined to confer lasting fame upon himself, as an instrument in the hand of God, has excluded all opposing thoughts. Here now is sufficient evidence of great defect of the rational faculties. Regardlessness of consequences alone cannot be so construed, for all true heroism displays it; but the utter insufficiency of the premises on which the act was based, is evidence of a mind ready to yield to the influence of any excessive fancy or enthusiasm that possesses it.

It is true that many persons accounted sane, possess prejudices which are but forms of the "fixed idea." All persons at times allow tastes, affections and emotions to usurp control over reason, whose useful servants they should be. Lack of benevolence is not always accounted an indication of insanity, although it may be displayed in cases where good sense would indicate a different course of action. Some men under the influence of dyspepsia, and women at the menstrual period, display abnormal emotional irritability. The persistence of those states, happily temporary, would be a form of emotional insanity. But it is unnecessary to adduce further evidence that the boundary-line between sanity and insanity is not a clear one, and that the attempt to draw it sharply is futile.

In like manner we will not attempt to fix responsibility for these states and their outcoming acts. It is too deep a question for the present state of science, and so we leave it. Practically, men hold one another responsible, and properly so, but charity and truth require that we do not attempt to draw a line which human vision cannot determine. There is another view to be taken of the matter, which is accordant with philosophy and effective in practice. The mind of the so-called insane are as open to the influence of motives as are those of the sane. If those motives are known, supply them in order to produce results. Pains and penalties affect the insane, though perhaps in different kind and degree, from those that control the sane. For the benefit of other disordered minds, if not for that of the guilty person, let them be inflicted. This will not be in a spirit of revenge, but in benevolent consideration for the greatest good of the greatest number.

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RECENT LITERATURE.

DE QUATREFAGES' THE HUMAN SPECIES.[1]—We looked forward with some degree of interest to the reception of this book, desirous to know how the author, who is well known to be conservative and an opponent of Darwinism as such, would look upon the question of man's origin from a savage state, and his antiquity, and other controverted anthropological topics. A perusal of the book, the interest of which is sustained from beginning to end, convinces us that the author by his fairness, sagacity and general culture, and scientific spirit, is uncommonly well qualified to express his opinion on mooted questions. The subject is treated in a comprehensive way and with the methods of the zoölogist, the author being distinguished for his anatomical work upon the lower animals. While disposed to ascribe to animals innate sense, consciousness and reason, and allowing that from an anatomical point of view "there is less difference between man and the superior order of apes, than between the latter and the inferior orders," and allowing that it is not "in the phenomena connected with the intelligence that we shall find the basis of a fundamental distinction between man and animals," he proceeds to place man in a separate kingdom from the animal kingdom, because of his moral and religious faculties. From this point of view he studies man, and discusses his relations as a species divided into numerous races, his origin, antiquity and original birth-place, his migrations from his specific center, and the steps

[1] *The Human Species.* By A. De Quatrefages, Professor of Anthropology in the Museum of Natural History, Paris. The International Scientific Series, New York, D. Appleton & Co., 1881. 12mo, pp. 498. $2.00.

in his acclimatization as he moved out in successive waves of migration from his birth-place. Our author then studies primitive man, the fossil human races, and finally discusses the physical and psychological characters of the present human races. From this sketch it will be seen in what a comprehensive way De Quatrefages has viewed the subject.

After endeavoring to prove the unity of the human species, a topic upon which there is now but little disagreement, he discusses Darwinism, and, while he accepts the doctrine of natural selection, claims that we have not yet discovered any *vera causa* of transmutation of species, though expressing his willingness to accept a theory of evolution when a good working one is discovered. He meanwhile strongly insists upon the fact that the early races of man have been modified during their migrations, and that the prehistoric races have been acted upon by climatic changes; thus far De Quatrefages is an evolutionist. His criticisms of Darwin's missing links, of Huxley's pithecoid man, of Wallace's views, are candid and some of his opposing views are certainly weighty.

As to the antiquity of man, De Quatrefages agrees with those who trace him back to miocene times, or to use his own, emphatic words, "Man was most certainly in existence during the quaternary epoch and during the transition age, to which the gravels of Saint Prest and the deposits of the Victoria cave belong. He has, in all probability, seen miocene times, and consequently the entire pliocene epoch" and, he adds, man may "have been contemporaneous with the earliest mammalia, and go back as far as the secondary period."

While, simply for want of evidence, discarding the views of Darwin and Haeckel, as to the origin of man from some lower mammal, and indulging in no speculations of this sort, he still applies to man Darwin's theory of natural selection and the principle of the struggle for existence among the different races.

After tracing briefly the history of the Aryan race, its origin on the southern slopes of the central Himalayas, in a region where the summer lasted only two months, and indicating the route this hardy race followed as it decended into Bokhara, and overrun Persia and Cabul before reaching the basin of the Indus, and finally reached the Ganges, and showing how this prepotent race overran the world until it has gradually become acclimatized from the poles to the tropics, he graphically compares the beginning of the human race to that of the far later Aryan race, in the following words:—

"The human species must have made a beginning like the Aryans. Upon leaving their center of creation, it was by slow stages that the primitive colonists, ancestors of all existing races, marched forth to the conquest of the uninhabited world. They thus accustomed themselves to the different conditions of existence imposed upon them by the north, the south, the east, or the west, cold or heat, plain or mountain. Diverging in every direction, and meeting with different conditions of life, they gradually established a harmony between themselves and each one of them. Thus acclimatization, advancing at the same rate as geographical conquest, was less fatal. The struggle, however, though mitigated indeed by the slowness of the advance, still existed, and many pioneers must have fallen upon the route. But the survivors had only nature to face, and, therefore, succeded, and peopled the world."

The studies of our author and the facts he presents are extremely interesting, as well as original and most valuable to the zoölogist. How he looks upon primitive man may be seen by another extract, which reads as if written by a confirmed evolutionist.

"The primitive type of the human species must necessarily have been effaced, and have disappeared. The enforced migrations, and the actions of climate, must of themselves have produced this result. Man has passed through two geological epochs; perhaps his center of appearance is no longer in existence; at any rate, the conditions are very different to those prevailing when humanity began its existence. When everything was changing round him, man could not avoid being changed also. Crossing also, has certainly played its part in this transformation."

He adopts De Salles idea that the earliest men had red hair, and that the present cases of races and individuals with red hair, and a yellow skin, as in the case of mulattoes, are examples of atavism. The primitive man probably had a prognathous jaw, and his language was a more or less pronounced monosyllabic one, though these are only conjectures. He believes farther, that while man did not enter the world with the innate knowledge and instincts of animals alone, still less did he appear in a fully civilized state "mature in body and mind;" he had only the aptitudes which were destined to undergo the marvellous development of later times.

The chapters on the action of conditions of life and heredity, will satisfy most of our readers as they are, whether the author will admit or not, simply modern Lamarckianism. De Quatrefages insists that "the first causes of variation are, *conditions of life and heredity*. In phenomena of this kind, conditions of life act as the supreme ruler. If they vary, they become modifying agents, if they remain constant, agents of stabilization. In both cases their result is to harmonize organisms with the conditions of their existence. Heredity, which is essentially a preserving agent, becomes an agent of variation when it transmits and accumulates the modifying actions of the conditions of life."

De Quatrefages in opposition to Lubbock and others claims, with citations of numerous authorities, that the lowest of existing savages, such as the Australians, have a moral sense and ideas of a God, and that so far as we know the earliest prehistoric races had the religious sense and an idea of a hereafter, as shown by the burial of their dead.

The book, though published in the present year, must have been prepared several years since, as it is strangely deficient in references to recent discoveries in American anthropology, such as Wyman's works, the discoveries of Professor J. D. Whitney in California and several other prominent archæologists, but still the work is a most useful and valuable one, in many respects written from an advanced standpoint, and the author distinguishes, as is not always done by modern anthropologists, between reasonable inductions and simple conjectures.

THE ZOOLOGICAL RECORD FOR 1879.[1]—This volume, though not paged consecutively, contains about as many pages as any of its predecessors, and is rather more bulky than the Record for the three preceding years. According to a notice in *Nature*, about 1000 new species were described during 1879 and are recorded in this volume; this shows a remarkable activity among the systematic zoölogists. Numerous and important changes have occurred in the editorial staff. The volume continues to be edited by Mr. E. C. Rye, but the deaths of Messrs. Alston and O'Shaughnessy, and the unfortunate resignation of Dr. Lütken of Copenhagen, who has so long and so ably edited the Echinoderms and Cœlenterates, is a serious loss to the list of editors; their places, however, have been, so far as we see, well supplied by younger men, and the Record still remains an indispensable reference book for zoölogists. As we have repeatedly said, those American zoölogists or entomologists, who live out of reach of libraries, would do well to own the volumes as they annually appear. The Record for 1880 is promised to subscribers in the course of the present year. Meanwhile the work of the editors will be greatly facilitated and the list of zoölogical papers and of new species and genera more perfect if American authors would think to send copies of their articles to the editor, care of Mr. Van Voorst, 1 Paternoster Row, London.

OUR SPORTING JOURNALS.[2]—No country can boast of better conducted sporting journals than the United States. The extent of our country furnishes many varieties of sport, and all are well represented by agreeable correspondents from every section of the continent. An important function of these periodicals, and one which they are effectively performing, is the preservation of the

[1] *The Zoological Record for 1879;* being volume sixteenth of the Record of Zoological Literature. Edited by EDWARD CALDWELL RYE, London, 1881. 8vo.

[2] *Afield and Afloat*, Philadelphia, 16 pp. *The American Field*, New York and Chicago, 28 pp. *The Forest and Stream* and *Rod and Gun*, New York, pp. 22. *The Chicago Field*, Chicago, 24 pp.

native fauna of the country. No one is more solicitous for the protection of our wild animals than the true sportsman. Without them, indeed, his occupation would be gone. It is through the pressure brought to bear by gentlemen represented by these journals, that such protective legislation as we have, has been obtained. In their pages we constantly find protests against the murderous practices of a class of hunters who care for nothing but the gratification of the instinct of destruction, and who would, if not suppressed, reduce the world to a condition as lifeless as that of our unfortunate neighbor the moon.

A valuable feature of these journals is the scientific element which enters into them. They all have a department devoted to exact information, which is generally edited by some competent scientist. In this, as in other respects, the NATURALIST recognizes in these journals natural allies in the work of interesting and instructing in the facts of nature. By these facts we live, enjoy, suffer and die; and the knowledge of them is a most agreeable combination of the *utile* with the *dulce*.

REPORT OF THE GEOLOGICAL SURVEY OF CANADA FOR 1878–79.[1] This volume possesses special interest from the large amount of novel information it gives regarding the geology and physical geography of British Columbia and of the region lying west of Hudson's bay. While the survey work has gone on in Canada, Nova Scotia and New Brunswick, having been performed in the latter province by Messrs. Bailey, Matthew and Ells, British Columbia has naturally, from the recent discovery of coal and gold mines, received of late particular attention. Mr. G. M. Dawson has had charge of this region. His report relates to the Queen Charlotte islands. He believes that two periods of glaciation have occurred on these islands, the second less intense, consisting of a temporary advance of glaciers from the various mountain systems. Mr. Robert Bell's report of his explorations of the Churchill and Nelson rivers, and around God's and Island Lakes is a continuation from the previous volume of his account of this vast and little known region. The remarks on the northern limits of forest trees in British America and on forest preservation will be of much permanent value, as well as the zoölogical and botanical appendices in the volume. To anthropologists the chapter by Mr. Dawson on the habits and architecture of the Haida Indians will prove well worth examining and of permanent value.

RECENT LITHOLOGICAL NOTICES.—In a brief paper on the age of the copper-bearing rocks of Lake Superior, which is extracted from the Proceedings of the American Association for the Advancement of Science, Boston Meeting, 1880, Mr. M. E. Wads-

[1] *Geological Survey of Canada.* ALFRED R. C. SELWYN, F. R. S., F. G. S., Director. Report of Progress for 1878–79. Montreal, Dawson Brothers, 1880. 8vo, with Maps and Plates.

worth thinks he has proved that the eastern sandstone conformably underlies the copper-bearing rocks, and that both are of the same geological age, and that the evidence brought forward by Dr. Rominger until disproved, shows that Messrs. Foster and Whitney were correct in regarding it as of Potsdam age.

Two other papers by Mr. Wadsworth appear in the Geological series of the Bulletin of the Museum of Comparative Zoölogy, (Nos. III, IV, May 1881). No. III is on an occurrence of gold in Maine, at Sullivan, Hancock county. No. IV, is of considerable interest, being a microscopical study of the iron ore, or peridotite of Iron Mine hill, Cumberland, R. I. The rock is similar to the celebrated iron ore of Taberg, Sweden, which has been worked for over 300 years. As it was impossible by field observations to determine the origin of the rock, Mr. Wadsworth concludes that it is most probably eruptive in its nature. This examination may serve, the author adds, as an illustration of the aid that microscopical lithology may be to the practical side of life.

THE ECONOMIC ENTOMOLOGY OF ONTARIO, CANADA.[1]—This is one of a series of reports which have been annually issued since 1870 by a Society which has done much good, both in the Provinces and in the United States, towards compiling and diffusing a knowledge of the habits of our more injurious insects. These reports are mostly made up of compilations from American authors, and while the scientific organ of the Society, the *Canadian Entomologist*, which has many contributors in the States, publishes much that is new about our common injurious insects, it would be well if our Canadian friends could find the opportunity to make and publish in their Annual Report original observations, for the field is a wide one, and original observers are sadly needed.

THE GEOLOGY OF INDIANA.[2]—While the larger proportion of this report is devoted to statistics and allied subjects, about one hundred pages bear upon the geology and palæontology of the State, the latter comprising descriptions of the more characteristic fossils of Indiana, by Dr. C. A. White, adapted for the use of the public and beginners in the study.

RECENT BOOKS AND PAMPHLETS.—Klassen und Ordnungen des Thier-Reichs. Dr. H. G. Bronn, Fortgesetzt von C. K. Hoffmann, Prof. in Leiden. Sechstes Band, III, Abtheilung. Reptilien, 16. und 17. Lieferung. 12vo, pp. 68, 3 plates. Leipzig und Heidelberg, 1881. From the editors.

Simosaurus pusillus, aus der Lettenkohle von Holeneck, von Dr. Oscar Fraas. Separat-Abdruck ans den Württemb. Naturw. Jahresheften, Jahrg. 1881. 8vo, pp. 6, 1 plate. From auth r.

Paleoethnologie de L'Antiquité de L'Homme dans les Alpes-Maritimes, par Emile Rivière. Planches en chromo-lithographie par J. Cillay. Gravures sur Bois par Guzman. 4vo, pp. 31, IV, plates. Paris, 1881. From the author.

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[1] *Annual Report of the Entomological Society of the Province of Ontario for the year 1880.* Printed by order of the Legislative Assembly, Toronto, 1881. 8vo, pp. 89.

[2] *Second Annual Report of the Department of Statistics and Geology, 1880.* (By JOHN COLLETT, Chief of Bureau.) Indianapolis, 1880. 8vo, pp. 544.

Sur les plus anciens Reptiles trouvés en France. Par M. A. Gaudry. 4vo, pp. 4. Paris 1881. From the author.

Note sur une Nouvelle et Très Petite espe e de Musaraigne, de Madagascar. Par le Dr. E. L. Trouessart. 8vo, pp. 12, 1 plate. Paris, 1881. From the author.

Revision synoptique du Genre Semnopitheque (Semnopithecus) et description de quelques especes rares au peu connus. Par le Dr. E. L. Trouessart. 8vo, pp. 33. Paris, 1881. From the author.

Horse, Part I, Zoölogy and Anatomy. Prof. W. H. Flower. 8vo, pp. 12, cuts. Reprint from Encyclopedia Britanica, 1881. From the author.

On the Male Generative organs of the Sumatran Rhinoceros (Ceratorhinus sumatranus). By W. A. Forbes, B. A., F. L. S., Scholar of St. John's College, Cambridge, Prosector to the Society. From the transactions of the Zoological Society. 4to, pp. 4, 1 plate. Cambridge, 1881. From the author.

On the Elephant Seal (Macrorhinus leoninus Linn) by William H. Flower, LL. D., F.R.S., P.Z.S., &c., &c. From the proceedings of the Zoological Society of London. 8vo, pp. 17. London, 1881. From the author.

On the Bursa Fabricii in Birds. By W. A. Forbes, F.Z.S. From proceedings of the Zoological Society of London. 8vo, pp. 15, cuts. London, 1881. From the author.

On some points in the structure of Nasiterna, bearing on its Affinities. By W. A. Forbes, B.A., F.L.S., Scholar of St. John's College, Cambridge, Prosector to the Society. From the proceedings of the Zoological Society of London. 8vo, pp. 2. London, 1880. From the author.

Contributions to the Anatomy of Passerine Birds, Part I. On the structure of the stomach in certain genera of Tongers. By W. A. Forbes, B.A., F.L.S., Scholar to St. John's College, Cambridge, Prosector to the Society. Proc. Zool. Soc. 8vo, pp. 6, cuts. London, 1881. From author.

Contributions to the Anatomy of Passerine Birds, Part II. On the Syrinx and other points in their Anatomy of the Eurylæmidæ. By W. A. Forbes, B.A., F.L.S., Scholar of St. John's College, Cambridge, Prosector to the Society. From the proceedings of the Zoological Society of London, May 4, 1880. 8vo, pp. 8, cuts. London, 1880. From the author.

Contributions to the Anatomy of Passerine Birds, Part III. On some points in the structure of Philepitta, and its position amongst the Passeres. By William A. Forbes, B.A., F.L.S., Prosector to the Society. Proceedings Zool. Soc., 1880, No. XXVI. 8vo, pp. 6, cuts. Cambridge, 1881. From the author.

On some points in the Anatomy of the Koala (Phascolarctos cinerus). By W. A. Forbes, B.A., F.L.S., F.Z.S., Prosector to the Society. From the proceedings of the Zoological Society of London, Jan. 18, 1881. 8vo, pp. 18, cuts. London, 1881. From the author.

Note on Mr. Barlett's communication on the habits of the Darter. By W. A. Forbes, B.A., Prosector to the Society. From the Zoological Society of London. February 1, 1881. 8vo, pp. 1. London, 1881. From the author.

On the Anatomy of Leptosoma discolor. By W. A. Forbes, B.A., F.L.S., Prosector to the Society. From the proceedings of the Zoological Society of London. June 15, 1880. 8vo, pp. 10, cuts. London, 1880. From the author.

On the Anatomy of the African Elephant (Elephas africanus Blum.). By W. A. Forbes, F.Z.S., F.L.S. From the proceedings of the Zoological Society of London. May 6, 1879. 8vo, pp. 18, cuts. London, 1879. From the author.

On the External Characters and Anatomy of the Red Uakari Monkey (Brachyurus rubicundus), with remarks on the other species of that Genus. By W. A. Forbes, B.A., F.L.S. Fellow of St. John's College, Cambridge, Prosector to the Society. From the proceedings of the Zoological Society of London, November 30, 1880. 8vo, pp. 26, 3 plates, cuts. London, 1880. From the author.

Note on a specimen of Denham's Bustard (Eupodotis denhami). By W. A. Forbes, B.A., F.L.S., Prosector to the Society. From the proceedings of the Zoological Society of London, June 15, 1880. 8vo, pp. 2. London, 1880. From the author.

On the contributions to the Anatomy and classification of Birds, made by the late Prof. Garrod, F.R.S. By W. A. Forbes, B.A. Fellow of St. John's College, Cambridge, Prosector to the Zoological Society of London. The Ibis. Fourth Series, No. XVII, January, 1881. 1. London, 1881. From the author.

Reports of Geological Explorations during 1879–80. With maps, and sections. James Hector, C.M.C., M.D., F.R.S., Director. Published by command. Gov. Printing Office, Wellington, New Zealand. 8vo, pp. 166, maps, cuts. Wellington, 1881. From the author.

Annual Report of the Board of Regents of the Smithsonian Institution, showing the operations, expenditures, and condition of the Institution for year 1879. 8vo, bound, pp. 631, cuts. Gov. Printing Office. Washington, 1881.

The Paleontologist, June 10, 1881. Contributions to Paleontology, fossils of the Lower Silurian formation, Ohio, Indiana and Kentucky. By U. P. James. 8vo, pp. 8. Cincinnati, 1881. From the author.

The Panama Canal and the Isthmus. By Col. James Worrall. Reprint from the Engineer's Club of Philadelphia. Vol. II, No. 2, 1881. 8vo, pp. 8. Philadelphia, 1881. From the author.

Proceedings of the California Academy of Science, at its regular meeting, held June 6, 1881. Reception of Lieut. Robert M. Berry, U. S. N., commanding U. S. Steamer Rodgers of the Jeanette Search Expedition. San Francisco, Cal., 1881. From the society.

New Species of Fossils and Remarks upon others from the Niagara Group of Illinois. By S. A. Miller. 8vo, pp. 12, 1 plate. Cincinnati, 1881. From the author.

The Mica Veins of North Carolina. By W. C. Kerr, State Geologist, Raleigh, North Carolina. From the Transactions of the American Institute of Mining Engineers. 8vo, pp. 6, cuts. New York, Feb., 1881. From the author.

The structure, affinities and species of Scolopendrella. By John A. Rider. 8vo, pp. 8, cuts. From the proceedings of the Natural Sciences of Philadelphia, 1881. Philadelphia, 1881. From the author.

Proceedings of the United States National Museum. 8vo, pp. 40, 1881. Washington, 1881.

Memoirs of the Peabody Academy of Science, Vol. I, No. V. 4to, pp. 14, 2 plates. Salem, Mass., 1881. From the academy.

Memoirs of the Peabody Academy of Science, Vol. I, No. VI. 4to, pp. 20, 1 plate. Salem, Mass., 1881. From the academy.

Illustrations of the Nests and Eggs of Birds of the United States. With Text. By Thomas G. Gentry, 4to, pp. 6, 2 plates. Part 8. Philadelphia, 1881. From the author.

Illustrations of the Nests and Eggs of the Birds of the United States. With Text. By Thos. G. Gentry, 4to, pp. 14, 2 plates. Part 9. Philadelphia, 1881. From the author.

Gill-Nets in the Cod Fishery, etc. U. S. Commission of Fish and Fisheries. By Capt. J. W. Collins. Bulletin U. S. Fish Commission 1, April, 1881. Washington, 1881.

Report of the State Commissioners of Fisheries for the years 1879 and 1880. 8vo, bound, pp. 151, cuts. State Printer, Harrisburg, 1881.

Notes on North American Microgasters with descriptions of new species. By C. V. Riley, M.A., Ph.D. From the Transactions of the Academy of Science of St. Louis, Vol. IV, No. 2. 8vo, pp. 20, cuts. St. Louis, April 6, 1881. From the author.

Johns Hopkins University, Baltimore. Studies from the Biological Laboratory. Editor H. Newell Martin, M.A., D.Sc., M.D. Associate Editor, W. K. Brooks, Ph.D., Vol. II, No. 1. Johns Hopkins University, June, 1881. From the editors.

Illinois State Laboratory of Natural History. Bulletin No. 4. Catalogue of Birds of Illinois. By Robert Ridgeway, Bloomington, Ill. 8vo, pp. 208, May, 1881. From the author.

A Report of twenty years' experience in the Department of Physical Education and Hygiene in Amherst College. To the Board of Trustees. By Edward Hitchcock. 8vo, pp. 16, table. Amherst, Mass, 1881. From the author.

Ward's Natural Science Bulletin. 4to, pp. 16, cuts. New York, June 1, 1881. From the author.

On an occurrence of Gold in Maine. By M. E. Wadsworth. 8vo, p. 1, No. 3.

A Microscopical study of Iron Ore, or Peridotite of Iron Mine Hill, Cumberland, Rhode Island. By M. E. Wadsworth. 8vo, pp. 6, No. 4. From the Bulletin of Museum of Comparative Zoology, at Harvard College, Cambridge, Mass., May, 1881. From the author.

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GENERAL NOTES.

BOTANY.[1]

THE POISON OF ZYGADENUS PANICULATUS.—A partial report from the Government chemist, shows that the bulbs of *Zygadenus paniculatus* Watson, have a glucosid to which their poisonous properties are attributed. Convulsions and speedy death follow the eating the bulbs of this plant. No antidote is yet known for it.—*M. E. Jones, Salt Lake City.*

GERMINATION OF ASTRAGALUS UTAHENSIS.—While gathering plants on the mountains near Salt Lake City (Utah Territory), I was very much puzzled by seedlings of our beautiful *Astragalus Utahensis* T. and G. It grows in the sand, first throwing up its small cotyledons, then producing two large round, woolly, simple leaves one inch in diameter, on a petiole often three inches long; after these comes another pair of similar leaves; then another with two leaflets on the long petiole, then another with either two leaflets (one on the end of the petiole and the other on one side), or three leaflets in the true odd-pinnate style; the next pair with either three or five, the next with five or seven, and so on. It is a long while after the germination of the seeds before one would suspect that it is an Astragalus, or even a member of the Leguminosæ.—*M. E. Jones, Salt Lake City.*

HOW OUR RED CLOVER BEHAVES.—In 1879 our crops of red clover *(Trifolium pratense)* were very luxuriant. After the haying season it made a second growth, in many instances little inferior to the first, and the seeds ripened very perfectly. But to the surprise of all the farmers hereabouts, the following spring (1880) found the clover seed completely killed out! This was very much of a discouragement to many of us who had but recently begun the cultivation of this excellent fodder plant in our comparatively new part of country. Our clover died, no doubt, from severe freezing in the winter of 1879–80, after a period of very great dryness during the latter part of summer, and all of the autumn. But little snow fell in the winter, so that the plants were without the protection which it usually affords. We all thought, however, that the seeds would germinate in the spring,

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

and produce a new set of the plants. But this did not occur, and in many meadows where the clover had been thickest, there were bare patches of ground all summer long. As clover is usually sown with timothy *(Phleum pratense)*, this last species thickened up and largely supplied its place, so that the hay crop was generally a fine one. During the spring of 1880 there was less than the usual amount of moisture in the soil, while the summer and early autumn were excessively dry. This diminution of moisture no doubt kept the clover seeds from germinating until this spring, when the ground is full of moisture. To the surprise of most people now, after the seeds have lain upon the ground two winters and one summer, they have germinated, and promise to make our meadows as luxuriant with clover as they were in 1879, and previous years! The little plants have sprung up by millions, simultaneously with that sown only a few weeks ago. They are so numerous that probably not one in a score will live. But through the unerring processes of "natural selection," only the fittest will survive; and what is of more practical moment, this unlooked for result will gladden the hearts of our farmers, who were sorely disappointed in the spring of 1880, to find that their clover did not wake up from its long winter sleep.—*Charles Aldrich, Webster City, Iowa, May 17, 1881.*

Sets of North American Algæ.—Several years ago Dr. Farlow, Dr. Anderson and Professor Eaton began the publication of sets of the marine algæ of the eastern and western coasts of North America. The first fasciculus of fifty species appeared in 1877; the second also containing fifty species in 1878; the third containing thirty species in 1879. The fourth fasciculus has just been issued (June), and like the first and second, it includes fifty species. It may well be said that it is impossible for any one to get anywhere more satisfactory representatives of the one hundred and eighty species already included in this important distribution. Not only are the specimens all that can be desired, but the eminent qualifications of the editors for this work, give an unusual value and high authenticity to the sets. We are glad to learn that this work has been fully appreciated by botanists, and have been told that it is now impossible to get copies of the first fasciculus, all having been disposed of. The separate fasciculi, however, are valuable, even if all cannot be obtained, and botanists in charge of college herbaria could hardly do better than to secure one or more of them, especially Fasciculus III, which is composed mainly of the larger species, such as Sargassum and its allies.

Botanical Notes.—Centuries VI and VII of Ellis' "North American Fungi" appeared during the last few days of May. Like their predecessors, these two centuries consist of well selected specimens, from nearly all of the groups of the fungi. Thus in Century VI, there are of Basidiomycetes, 22 species, Ascomycetes 44, Myxomycetes 1, and of the so-called imperfect fungi 33. In Century VII, there are of Basidiomycetes 13, Ascomycetes 42. Mixomycetes 2, miscellaneous species and imperfect forms 43. These five sets, which now aggregate 700 species, are well nigh indispensable to the botanist who wishes to intelligently study the lower plants. Their cheapness ($7 per Century, mounted and labeled), ought to commend them to the curators of college herbaria.——Professor Spalding, of the University of Michigan, has reprinted from the *Therapeutic Gazette*, an interesting pamphlet of 16 pp. on *Ustilago maydis*, the smut of Indian corn. Several wood-cuts serve to illustrate the text.——Dr. Sturtevant has been studying the subject of seedless fruits, and has embodied his results in a paper recently printed by the Massachusetts Horticultural Society. He has brought together a large number of very curious facts.——G. E. Davenport describes in the June *Torrey Bulletin* a new fern, *Cheilanthes Parishii*, from California. An excellent plate, by Faxon, accompanies the text.——Professor Tuckeman in the same number of the *Bulletin* directs attention to a forthcoming work ("Symbolæ Licheno-Mycologicæ") by Dr. Minks, of microgonidia-fame. From the Professor's notice it appears that Dr. Minks proposes to show, not that lichens are fungi, but that many plants hitherto called fungi are in reality lichens!——Dr. Farlow also describes a Carpinus, which grew in a jar of water!——The June *Botanical Gazette* contains many valuable papers, among which are the following: Descriptions of New Plants from New Mexico and Arizona, by E. L. Greene; Chlorophyll, by Professor Coulter; Iowa additions to the N. A. Flora by Dr. Engelmann; New Species of Fungi, by C. H. Peck. Dr. Engelmann describes a new species of Conifer, *Tsuga Caroliniana*, nearly related to our common hemlock spruce. It is from the mountains of North and South Carolina.——A catalogue of the Musci of the valleys of the Serchio and the Magra (central Italy west of the Appenines), by Fitzgerald and Bottini, occupies about 100 pp. of the April number of *Nuovo Giornale Botanico Italiano*. Three hundred and sixty-nine species are noticed. Full notes as to habitat and locality accompany each entry.

ZOÖLOGY.

Brief Notes on Some Iowa Birds.—I have heretofore stated my belief that the indigo bird (*Cyanospiza cyanea* Baird), is a summer resident of this section. I have no doubt of this—for I saw them here in our thickets on many occasions during the month of May, though I have not yet found a nest. But they sang in the tree-tops, and hunted insects as if "to the manor born;" to-day I saw another, so I concluded that their nests must be near by.

I also mentioned seeing a robin (*Turdus migratorius*) during the "blizzard" times last winter. After my article was sent away, I repeatedly saw one, which I presumed to have been the same bird. It undoubtedly tarried with us during all of our unexceptionably severe winter. I am also reliably informed that these birds wintered in large numbers in Boone county, thirty or forty miles south of this place, that they made their homes in some of the deep ravines which extend back from the Des Moines river. In these ravines there would generally be open water from springs, about which they could doubtless pursue food, while the high timbered bluffs would very materially modify the severe climate.

A few nights ago a young friend was passing an old mill just across the river from me, with a lighted lantern. His attention was attracted to some flying creatures, which came very close to him, and which he thought at first were bats. But stopping a moment, he caught two of them, and they proved to be swallows, which had lately arrived, and were building their nests under the eaves of "that ancient mill." I read of birds being attracted by a light, and killing themselves by flying against the windows of lighthouses, or other elevated buildings, but never before of an instance of this kind.

I have often thought that there is one marked difference between the blue jays of western New York and Pennsylvania, as I knew them when a boy, forty years ago, and ours here in Iowa. In those days there were still deep woods in that region where great groves of pine and hemlock had never been disturbed by the woodman's axe. These dark recesses, miles from settlements, were favorite resorts of the blue jay, and the recollection of their far away screams and calls comes back to me whenever I hear the same notes here! But there is this difference: Our jays are very tame, almost half domesticated, coming freely to our barn-yards and corn-cribs, and helping themselves, in a bold, confident way, often robbing the nest of a hen or a duck as freely as they perpetrate the same depredations upon the robins and thrushes. Some years, ago so tame are they here, the little daughter of a friend of mine saw a blue jay very busily pecking at some object, doubtless an ear of corn. Approaching stealthily, she clapped her hands upon his sides and captured him! It is amusing to see them eat a kernel of our large western corn. They cannot swallow the grains whole, and are compelled to break them into two or more pieces. This they do with powerful strokes of their bills, while holding the grain upon the ground or other hard surface with one foot. These strokes come down as systematically as a blacksmith hits a hot iron with his hammer! Often three or four blows are needed to divide the object, so it can be swallowed and the bird looks around at every stroke to see if the coast is clear. But back in western New York and Pennsylvania, they were shy and secretive, living for the most part in the grand old woods. It seems to me this difference in habits may be largely due to the scarcity of timber in this region, which makes it a necessity for them to live near the abodes of men. As population increases, their habits of familiarity are increased, and so the blue jay has become one of the tamest and most domestic of our Iowa birds, tolerated for his beauty and sprightliness in spite of his alleged, and I fear too often apparent, depredations upon other birds.—*Charles Aldrich, Webster City, Iowa, June 11, 1881.*

The Organs of Smell in Land Snails.—Dr. Sochaczewer has endeavored in the *Zeitschrift für wissenschaftliche Zoologie* (1880), to decide between the claims of the tentacles, the organ of Semper, and the pedal gland to be regarded as the organ of smell in land snails. It has been known for many years that the tentacles each contain a large ganglion whence radiate five fibers with the investing epithelium, giving rise to terminal knobs, endowed apparently with a sensory function. Naturalists differ as to the office of these organs, for some, like Linnæus, regard them as having the sense of touch. In order to decide the matter, Dr. Sochaczewer cut off the tentacles of *Helix pomatia*, and after the healing process was completed, the snail was placed in the center of a flat plate, the edge of which was smeared with oil of turpentine. The movements of the snail were very slow and uncertain. When it approached the edge of the plate, it behaved itself exactly as did a snail in which the tentacles were completely uninjured, returning at last to the middle of the plate, and withdrawing itself into its shell. This and similar experiments seem to show that the tentacles are not the seat of the sense of smell.

The author next considers Semper's organ, discovered by Professor Semper in 1856. Small in Helix, Arion and Lymnæus, it is best developed in Limax, where it exists in the form of four or five glandular lobes in the sides of the mouth. The author decides that this is simply a gland without any sensory function, and that the organ of smell exists in the foot-gland which is well supplied with nerves, and is of some size. The author claims that in this structure, which is situated in the middle line of the foot, are found the three necessary factors of an olfactory organ, *i. e.*, of sensory cells, the entrance of air, and the addition of a secretion from a gland. The orifice at the anterior margin allows the air to enter; the olfactive matters contained in it are mixed with the secretion, and so come in contact with the peripheral nerve-cells. The author concludes by pointing out that the sensory arrangements which obtain in the invertebrates are not to be too closely or hastily compared with those seen in vertebrate animals.—*Journal of the Royal Microscopical Society.*

The Structure of the Orang Outang.—Under this title Dr. H. C. Chapman has published in the Proceedings of the Academy of Natural Sciences of Philadelphia, notes of the dissection of a male orang. The author states that "the cerebellum in my orang was relatively larger than that of man, but smaller than that of either the chimpanzees I have dissected, and was just covered and no more by the posterior lobes of the cerebrum." He closes his paper with the following remarks:

"What can be inferred from the general organization of the orang as to its relation to the other primates? The orang like man has twelve ribs, whereas the gorilla and chimpanzee have thirteen; on the other hand, the carpal and tarsal bones are nine in number in the orang, while the chimpanzee and gorilla agree with man in having eight. The upper extremity of the orang resembles that of the gorilla in the absence of the *flexor longus pollicis*. The chimpanzee and man are alike in this respect, at least the slip from the *flexor longus digitorum* in the former is functionally a *flexor longus*. In the absence of a *flexor longus hallucis*, and in the presence of an *opponens hallucis*, the orang differs from man, the anthropoids, and all the monkeys. The great blood vessels arise from the arch of the aorta in the gorilla and man in the same way; the same disposition is usually seen in the chimpanzee, rarely in the orang. The lungs in the orang are not divided into lobes, as in the gorilla, chimpanzee and man. The stomach in the gorilla and chimpanzee is human in its form; in the orang, however, it is quite different. The peritoneum in the gorilla, chimpanzee and orang is like that of man; in the lower monkeys it is different. The brain of the orang in its globular form, in the cerebellum being usually covered by the cerebrum, and in the development of the first occipital gyrus, resembles man's more than that of the gorilla and chimpanzee. On the other hand, the frontal and temporal lobes in the orang are not as much convoluted as in the chimpanzee, and still less than in man, and the island of Reil is not convoluted at all, at least in my orang.

Marine Animals in Aquaria.—The great aquarium and laboratory founded by Dr. Dohrn is exerting a decided influence on the progress of biology, as many of the leading German, English, Russian and Italian zoölogists have, owing to the unusual facilities for studying living marine animals of the Bay of Naples, produced a series of works of high interest and value. To give some idea of the facilities enjoyed by those who work at this celebrated seaside laboratory, the following account is compiled from a notice in the Journal of the Royal Microscopical Society:

Among animals breeding in the aquarium, none are so easily observed as the large crustacea and molluscs. The large crabs pair and lay eggs, though the zoëæ or larvæ, could not be reared; lobsters notwithstanding their salacity, rarely produced eggs in captivity. Of molluscs, the best breeders are species of Loligo, Sepia, Aplysia and Doris. Though many nudibranchs lay freely, their eggs never come to maturity. But many of the lower animals without any care whatever, thrive and multiply wonderfully. Compound Tunicates take the lead among these "spontaneous" productions. The graceful Botryllidæ exuberate in both the northern and southern tanks. Compared with Ascidians, Polyzoa are not very generally distributed. Bugula is now the commonest, especially in the compartment for eels, where it flourishes along with Zoanthus and Hydractinia. Mullet and some other fishes, hurtful to various low growths, soon scour the rocks tenanted by Ascidians.

The tank allotted to Annelids affords a spectacle of great beauty and variety; in short, it is a perfect microcosm. Of its inhabitants, we can only note the young of a species of Spirorbis, a well known commensral of Palinurus. This annelid multiplies so fast that much trouble is spent in removing its tubes, shaped like a post-horn, which soon cement themselves with obstinate firmness to the glass windows of the aquarium.

Fishes, if we except Selachians, do not breed well in the aquarium. Otherwise, they are flourishing prisoners; the conditions unfavorable to their propagation have not yet been thoroughly ascertained.

THE EYE-LIKE ORGANS OF THE SKIN OF CERTAIN FISHES.—M. Ussow, in the Bulletin of the Imperial Society of Naturalists of Moscow, 1879, gives an account of these singular organs in *Astronesthes*, *Argyroplicus*, *Chauliodus*, *Gonostoma*, *Maurolicus*, *Scopelus* and *Stomias*. He finds that in *Astronesthes*, *Chauliodus* and *Stomias* there are eyes, furnished with bodies analogous to crystalline lens, humor, retina, and pigment. He traces their nervous connection to the interspinal nerves. In the remaining genera he finds the structure to be much more simple. Their cavities containing only a gelatinous connective tissue. Mr. Solger observes the latter kind of bodies in the American genus *Porichthys*, and thinks them to be rudimental eyes. During the present year, Dr. Leydig has investigated the same objects, and confirms the results obtained by Ussow. He, however, holds a different opinion as to their uses. He thinks them electric organs more or less developed. It is known that they are in some of the genera at least, luminous. Dr. Günther describes an extraordinary fish of the cod family from great depths of the Atlantic, in which the eyes are replaced by a large, probably luminiferous, organ which covers the entire frontal part of the top of the skull.

MASON'S MICROSCOPIC STUDIES IN THE CENTRAL NERVOUS SYSTEM OF REPTILES AND BATRACHIANS.—A third article by Dr. John J. Mason on this subject, appears in the Journal of Nervous and Mental Disease for January, 1881. The author has studied the nuclei of the spinal cord of the alligator and *Heloderma suspectum*, our largest lizard; and he reaffirms from his new studies the law previously formulated that "the nuclei of the so-called motor cells of the central nervous system have, in the same individual, average diameters, which are proportional to the power developed in the related muscles."

THE JELLY FISHES OF NARRAGANSETT BAY.—A beautifully illustrated memoir entitled "Studies on the jelly-fishes of Narragansett bay," by J. W. Fewkes, appears in the Bulletin of the Museum of Comparative Zoölogy, under date of February, 1881. It contains an account of certain new Acalephæ, collected by the author during three summers spent at Newport, with anatomical and embryological notes. As it is impossible to give an abstract of the article, we would refer the reader to the memoir itself, merely stating that a number of interesting forms originally described by Professor McCrady from Charleston, South Carolina, range as far north as Newport.

ZOOLOGICAL NOTES.—In a list of mammals collected by Dr. E. Palmer, in north-eastern Mexico, with field notes by the collector, published in the Bulletin of the Museum of Comparative Zoölogy, it is stated that the bison was killed as food by the settlers at Monclora and Parras probably half a century after the Spanish conquest. "There seems to be no reason why, so far as the nature of the country is concerned, the bison may not have ranged also to Saltillo." Dr. Palmer found no indications of the prong-horn antelope in any portion of the region he traversed. This is an important negative fact, adds Mr. Allen, as tending to fix the northern limit of this species, as it is known to occur farther westward in the northern parts of the States of Chihuahua and Sonora, while Berlandier is cited by Alston in the Biologia of Central America as authority for the statement that its range extends "southward at least throughout the State of Tamaulipas."——The *Novice*, an Austrian paper, announces the discovery, by MM. Robie and Clessen, of two new species of snails, near Predwor, in Carniola. They are without eyes, and have no need of the organ of sight, since they live in the dark, in water flowing very slowly underground. They have received from their discoverers the name of *vitrinella*, one of them, on account of its slender form, being further named *gracilis*.——It appears from a paper by Professor T. J. Bell, that of the genus Asterias (Asteracanthion of other authors), which embraces the common star fish or five finger, there are more than eighty species already described; Bell adds five to the list, and indicates how the species should in his opinion be classified.——The "sea-spiders" (Pycnogonida) dredged, under the supervision of Alex. Agassiz, by the U. S. coast steamer *Blake*, dredged along the east coast of the United States during the summer of 1880, have been described, with numerous figures, by Mr. E. B. Wilson, in the Bulletin of the Museum of Comparative Zoölogy. The remarkable feature in their deep sea forms, as in those elsewhere found, are their colossal size, compared with the shoal water forms; also, in a number of forms, the eyes (ocelli) are (1) either rudimentary and destitute of pigment; or (2) entirely absent; while on the other hand in Pallenopsis the eyes are relatively of unusually great size. The remarks on the morphology and innervation of the anterior appendages are excellent, and have an intimate bearing on the systematic portion of these creatures, for Mr. Wilson sagaciously remarks that "it is easily possible that the external resemblances of a Pycnogonid to an Arachnid are those of analogy only, and have no morphological significance. This is the more probable from the extreme variability of the three anterior pairs of appendages in position and structure."——In the same Bulletin Mr. S. Garman reports on the Selachians, all captured at great depths, belonging to species hitherto unknown; the results of this and other deep sea work indicate (1) that the migrations of these animals, including the fishes, are much more limited in extent than has generally been supposed; and (2) these creatures especially the skates, are more or less affected by a period of comparative inaction, in a measure corresponding to what obtains among Batrachia and Reptilia. Concerning the migrations of fish and Selachians, there are many species in our waters, the author remarks, "whose movements do not amount to more than short runs from shoal to deeper water and back again. Others would seem to extend their travels from the coasts and banks to the Gulf Stream. And still others make much more extensive migrations."——The anatomy of the African elephant is much less known than that of the Asiatic species, which is naturally far more abundant in menageries and zoölogical gardens. Messrs. Plateau and Liénard have recently published the results of the dissection of an African species, with especial reference to the heart, larynx and male reproductive organs. *Apropos* of this interesting animal, it would seem probable that Yankee perseverance and painstaking may enable us to raise our own elephants. Barnum's baby elephant, born at Philadelphia, is growing rapidly, and is a vigorous creature in its third year. Its mother is again about seven months along in pregnancy, and it is therefore not unlikely that a second one will be born in this country. The sexes in Barnum's herd of elephants pair readily in confinement. We learn on good authority that an American resident in India of thirty years, never heard of an elephant being born there, and was astonished at learning of the birth of one in the United States.——Mr. W. A. Forbes has succeeded Professor Garrod as prosector to the zoölogical society of London. He is successfully rivaling his able predecessor in the quality of his papers, which are chiefly devoted to the anatomy of mammalia and birds.——Dr. Trouessart has completed his catalogue of the mammalia as far as the end of the *Rodentia*, including that order with the *Prosimiæ* and the *Quadrumana*. The number of species is so far 2061. The catalogue will be very useful to students, as it includes synonymy and geographical distribution, as well as the extinct species.——Mr. Gentry continues his illustrated quarto work on the nests and eggs of American birds. The last plates issued are very good, and the text is written with considerable literary ability.——Mr. Ridgway gives a list of the species of birds of Illinois which is critical and very full, including 341 species.

ENTOMOLOGY.[1]

The Egg-case and Larva of Hydrophilus triangularis Say. As the nidus and young of this beetle do not appear to have been observed, a few notes gathered from an examination of several egg-cases and of larvæ hatched from them may be of interest. The cases were collected about the first of June, 1876, from a small pool of water in the Normal School grounds at this place. A half dozen were obtained floating at the surface of the water, with bits of weeds and dead leaves attached to the upper surface as floats (Fig. 1). In no case were they secured to living plants,

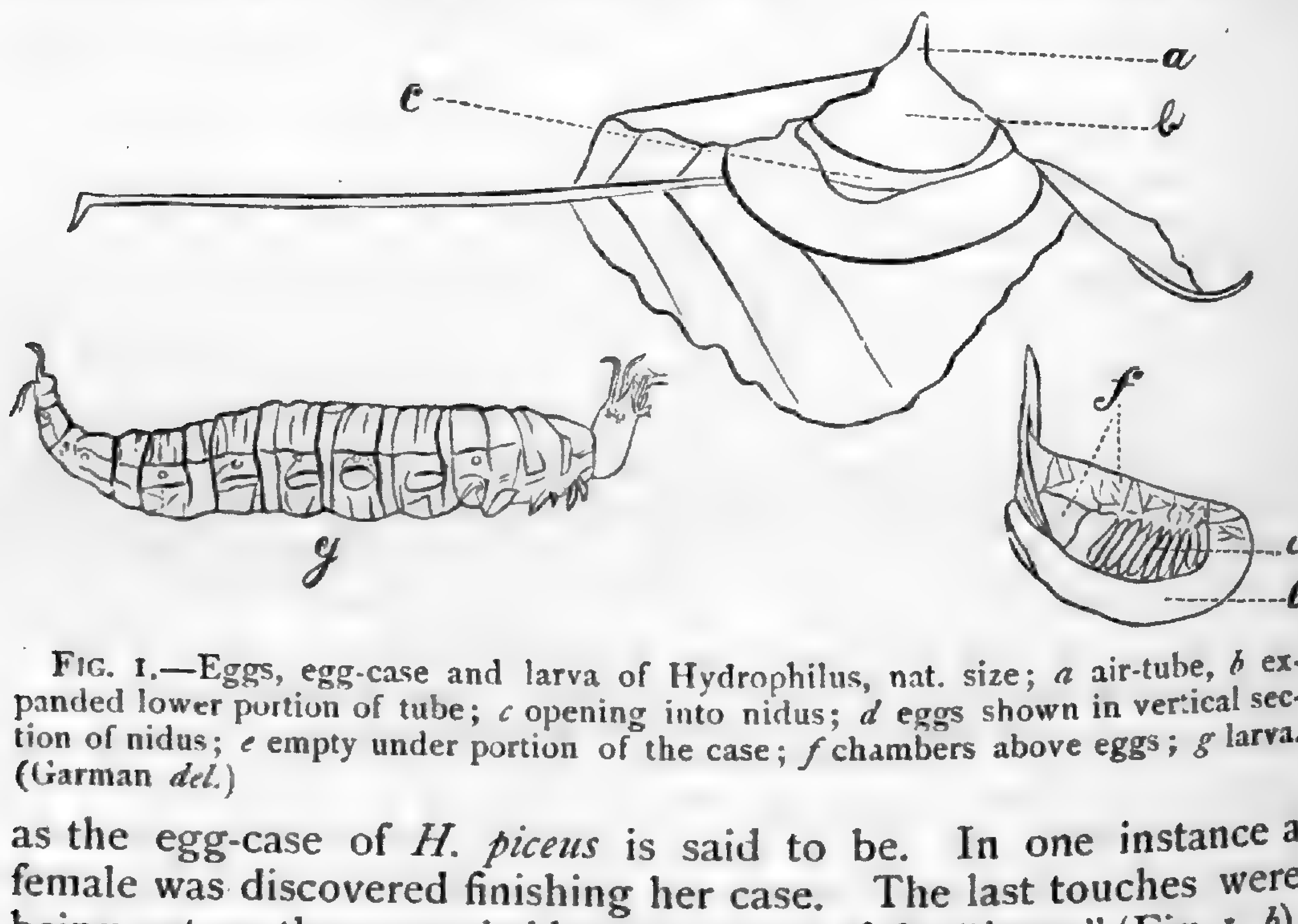

Fig. 1.—Eggs, egg-case and larva of Hydrophilus, nat. size; *a* air-tube, *b* expanded lower portion of tube; *c* opening into nidus; *d* eggs shown in vertical section of nidus; *e* empty under portion of the case; *f* chambers above eggs; *g* larva. (Garman *del.*)

as the egg-case of *H. piceus* is said to be. In one instance a female was discovered finishing her case. The last touches were being put on the expanded lower portion of the "horn" (Fig. 1, *b*), this part of the latter being then of a rich yellow color. The nidus and its maker were lifted gently in the hand and carried a distance of about one hundred yards; and so absorbed was the beetle that she continued her work, and on being put into a vessel of water finished her task. When the case was next observed the yellow material had been concealed by a brown gummy coating.

The surface of the egg-case is smooth, light brown, and resembles very closely that of the nidus of the large black and yellow spider, *Argiope riparia* (?). Viewed from above or below, the outline is a good circle. The diameter is about 20^{mm}, the

[1] This department is edited by Prof. C. V. Riley, Washington, D. C., to whom communications, books for notice, etc., should be sent.

depth about 14^{mm}. The spine-like process (Fig. 1, *a*) which arises from what may be termed the front of the case is of a dense horny nature, quite unlike the remainder of the case. It expands below into a hatchet-shaped plate (Fig. 1, *b*). The spine indeed is formed by this plate narrowing and folding backwards above the case until its edges almost meet, thus forming a partial tube, which, as will be seen later, facilitates the entrance of air into the interior. The length of the tube, as also the shape of the plate, varies somewhat. Below the hatchet-shaped expansion is a narrow opening (Fig. 1, *c*) into the case, allowing the water free passage from without and permitting the escape of the larvæ.

The eggs form a discoid mass suspended from the roof of the nidus. They are all placed vertically and arranged closely in a single layer. (See Fig. 1, *d*.) Specimens (in alcohol) are cylindrical, about 4^{mm} in length and about 1^{m} in diameter. One hundred and seven were counted in one nidus. The mass is surrounded by a rather loosely woven silken coat, while each egg is wrapped separately in a coat of similar character. Below, at the sides, and behind the mass, is left a vacant space (Fig. 1, *e*) into which the opening in front gives access to the water. The silken material above and in front of the eggs is so disposed as to form large cells (Fig. 1, *f*) and these connect with the tube through which air is admitted.

The chief object of the peculiarly constructed case appears to be to ensure a supply of air to the newly hatched larvæ. As will be seen by reference to the figures, this object is attained by excluding water from, and admitting air into, the upper part of the case, and by attaching a float to the upper surface. This keeps the top of the case at the surface of the water while the air-tube projects above.

In the very young larvæ, the head is relatively wider and larger every way than in older examples; the body is covered by a coat of short, fine pubescence, becomes gradually wider from behind forwards, and the general color is a uniform grayish-brown, becoming lighter beneath. In older examples, the body is sensibly narrowed before and behind. In the largest specimen examined, the pubescence is wanting, and there is a faint dorsal line, with a broader waved line bordered outside with dark on each side of it. The head is so attached to the body as to project obliquely upwards; it is reddish-brown, with obsolete darker shades. The mandibles and labium are narrowly edged with black. The legs are of the same color as the head. The skin is minutely roughened and deeply wrinkled. The lateral appendages of other Hydrophilus larvæ are represented by elevations so slight as to be scarcely visible. From the under side of the last segment of the abdomen in this species, arise two light-colored, cylindrical, flexible appendages, about equal in length to the first joint of the antennæ. (For the larva, see Fig. 1, *g*.)

Figure 2, *a* renders a detailed description of the mouth-parts unnecessary. A noticeable characteristic is the difference in size and shape of the right and left mandibles. The right is longer, more slender and strongly curved, and has a bicuspid prominence on the cutting edge. The left one has a single minute tooth. The maxillæ are the most prominent mouth parts, and are probably chiefly useful as palpi. They are especially large in the youngest larvæ. The terminal palpial joint and the small appendage of the second joint have areas at their apices from which arise tactile rods. The inner edges of the long basal joints of both the maxillæ and antennæ are beset with numerous straight hairs. Lateral basal prominences of the labium are roughened with minute, depressed, tooth-like processess.

FIG. 2.—Head and leg of Hydrophilus larva, enlarged; *a*, head and mouth parts; *b*, leg. (Garman *del.*)

The legs do not vary perceptibly; all have the femora supplied with fringes of soft hair (Fig. 2, *b*).

The striking feature of the tracheal system is two large longitudinal trunks, one on each side of the middle line of the body (Fig. 3 *a*, diagram). They open in large spiracles under the posterior upper edge of the last abdominal segment but one (Fig. 3. *b*). Properly it is perhaps the antepenult, as Gegenbaur states that spiracles are never borne by the two terminal abdominal segments. The balance of authority seems to be in favor of these being the only spiracles in the larval Hydrophilus. In the case of the larvæ of two species examined this is certainly not true; for besides the large terminal pair, nine pairs of spiracles, with branches running to them from the large trunks, can be counted. One of these

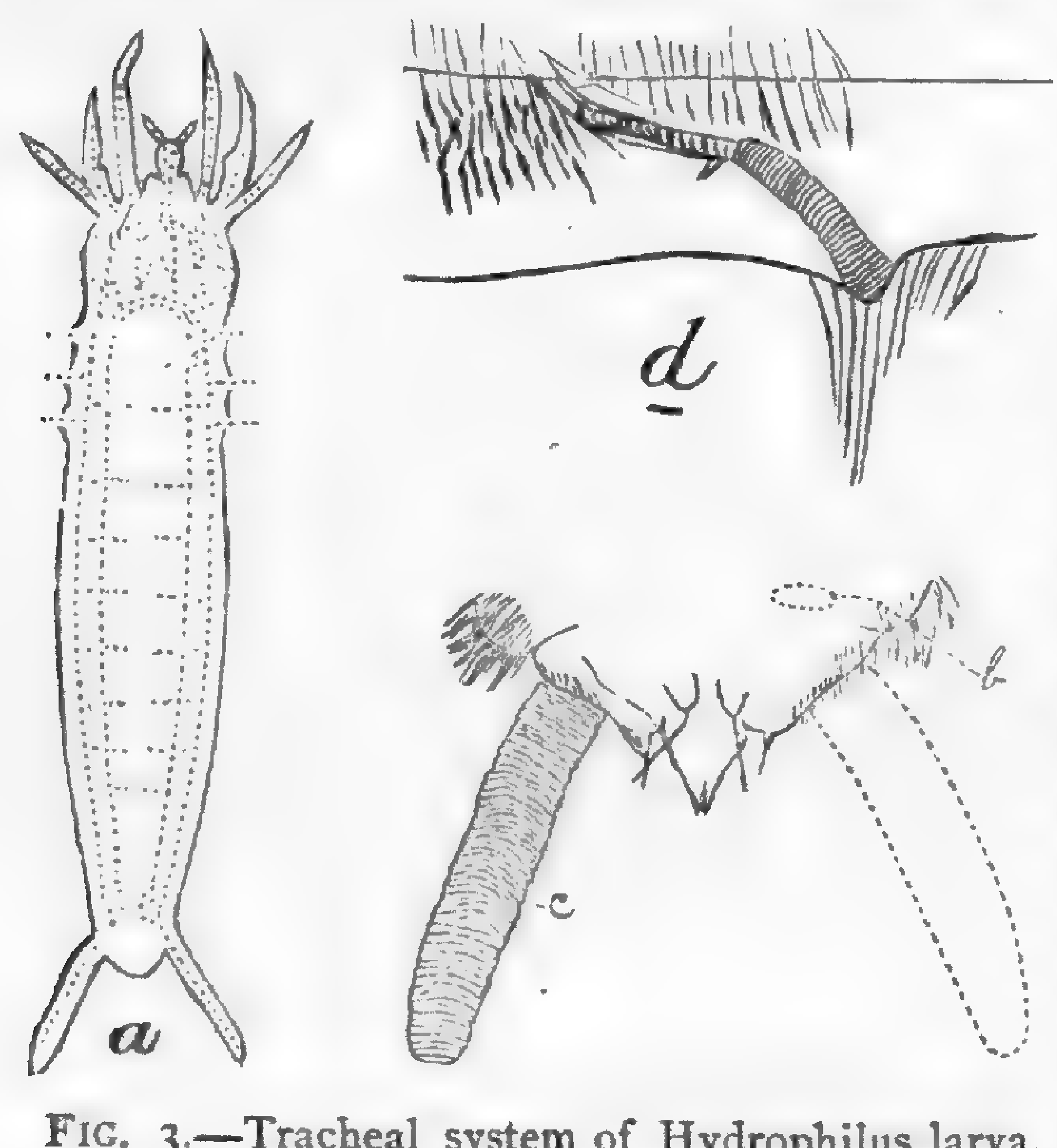

FIG. 3.—Tracheal system of Hydrophilus larva. *a*, diagram showing the main branches of tracheal system; *b*, opening of large spiracle; *c*, terminal appendage; *d*, stigmatal branch of tracheæ. (Garman *del.*)

larvæ has lateral filaments a sixteenth of an inch long, but there is no connection between them and the stigmatal branches of the tracheæ. (Fig. 3, *d*, shows one of the branches.) The latter open immediately over the large trunks some distance above the lateral filaments. They are very short, are comparatively small, pass directly upward to the skin from the trunks, and consequently a good view of them can scarcely be obtained without dissection, certainly not without rendering the specimens transparent. They can be best seen by cutting out a strip of skin above the trunks, placing it, with the air-vessels attached, under the microscope, and rolling one of the trunks aside with a needle. The first spiracles are situated in the anterior border of the mesothorax, the second in the anterior border of the metathorax, and following these there are seven others in the abdomen besides the large terminal pair, making ten pairs in all.

Westwood states that the terminal appendages of the abdomen (Fig. 3, *c*) are respiratory organs. With this statement in mind I was prepared to see them well supplied with tracheæ, and was surprised to find, instead, but a simple branch of not more than one-twentieth the diameter of the appendages.

The trunks give off numerous short branches in the abdomen and thorax near the points from which the branches proceed to the stigmata. At the posterior part of the prothorax the trunks divide, one large branch on each side continuing forward till near the front of the head, where branches are given off supplying the mandibles, maxillæ and antennæ. At about the point at which these branches leave the main branch, an arch is formed by a branch from each side curving forwards towards the middle line and there uniting. The anterior portion of this arch lies within the base of the labium, where branches pass forward from it into the labial palpi. The other branches produced by the division of the trunks form a large arch, the anterior portion of which lies within the base of the head. Branches from this arch pass along each side of the œsophagus, while others supply the sides of the head and the region of the eyes. (See diagram, Fig. 3, *a*.)—*W. H. Garman, Normal, Ills.*

ANTHROPOLOGY.[1]

Comparative Biology.—The comprehensive term by which the study of the natural history of man is designated has become well nigh settled in its application. In the summaries which have been published in the Naturalist, the Smithsonian Report, and Baird's Annual Record, it has been found convenient to adopt the following subdivisions of Anthropology: 1. Anthropogeny, including both the laws of environment and inheritance as effecting and affecting our race; 2. Archæology, a term well understood; 3. Anatomy, specific and comparative; 4. Psychology, involuntary

[1] Edited by Prof. Otis T. Mason, 1305 Q Street, N. W., Washington, D. C.

and voluntary; 5. Ethnology, including ethnography, the description and discussion of races; 6. Philology, noting the origin and elaboration of language; 7. Technics, or the manifestations of handicraft in peace and war; 8. Sociology, noting the origin and differentiation of society; 9. Religion, embracing all discussions concerning the origin and forms of the religious sentiment; 10. The description of all the instrumentalities of research, museums, libraries, journals, works of general merit, instructions to collectors, instruments of precision, and bibliography.

The term comparative biology, while really embracing all that relates to all living beings, has, in anthropology, more immediate relation with classes three and four. We have just laid aside a charming work which, in another department of zoölogy, discusses the subject of biology in these two aspects. We refer to St. George Mivart's work on the Cat, published in 1881, by Charles Scribner's Sons of New York. Indeed, as hundreds of intelligent students of anthropology, and especially of archæology, never see the inside of a dissecting room, there is no work in existence which renders familiarity with biological terminology so easy as this. The subject is always at hand, and can be examined in every stage of the great life cycle with little expense and trouble. Mr. Mivart's work in the plainest language and with excellent illustrations explains the history, form, skin, skeleton, muscles, alimentary system, circulation, respiration and secretion, nervous system, and development. In chapters XII—XV, the author discusses the different kind of cats, the cat's place in nature, its hexicology, and the pedigree and origin of the cat.

These, as previously stated, are useful to the anthropologist, who is not a physician, since they enable him to familiarize himself with the actual in nature. The portion of the volume which entitles it to mention in this department, however, is chapter XI, upon the psychology of the cat. The word "Psychology" is taken to denote all the activities, both simultaneous and successive, which any living creature may exhibit. Mr. Mivart is a dualist in metaphysics and therefore is opposed to the opinion that living beings are mere automata. On the other hand, he holds a view peculiarly his own with reference to the spiritual nature. "The *psyche*, or *soul*, is that principle of individuation which makes the animal what it is, though it has no actual existence apart from the matter it vivifies. Yet it is the animal, *par excellence*, the matter of which it is composed being but the subordinate part of that compound but indissoluble unity—the living animal." In the same chapter is a classification of the cat's *active powers* into eighteen categories, of man's into twelve, and a discussion of the scope and characters of cat language.

Had we space, it would be profitable to discuss some of the author's grounds at length, but this is one of the works on anatomy which students of anthropology cannot afford to omit.

THE BRITISH ASSOCIATION IN 1880.—The Report of the fiftieth meeting, held at Swansea in August and September, 1867, is a volume of 740 pages, with an appendix of 92 pages giving a list of members. For the benefit of reference the titles of all addresses, reports and papers bearing on anthropology, are appended:

Sixteenth and concluding report of the committee consisting of John Evans, Sir John Lubbock, Edward Vivian, George Busk, William Boyd Dawkins, William Ayshford Sanford, John Edward Lee and William Pengelly, appointed for the purpose of exploring Kent's cavern, pages 62, 575.

First report of the committee, consisting of Professor A. Leith Adams, the Rev. Professor Haughton, W. Boyd Dawkins and Dr. John Evans, on the caves of the south of Ireland, pages 209, 575.

Report of the anthropometric committee, consisting of Dr. Farr, Dr. Beddoe, Mr. Brabrook, Sir George Campbell, F. P. Fellows, Maj.-Gen. A. L. F. Pitt-Rivers, F. Galton, J. Park Harrison, James Heywood, P. Hallet, Leone Levi, Dr. F. A. Mahomed, Dr. Muirhead, Sir Rawson Rawson, Charles Roberts, Professor Rolleston, pp. 120, 625, 670.

On the site of a Palæolithic Implement manufactory at Crayford, Kent, by F. C. J. Spurrell, p. 574.

Notes on the occurrence of stone implements in the Coast Laterite, south of Madras, and in high level gravels and other formations in the South Mahratta country, by R. Bruce Foote, of the Geological Survey of India, p. 589.

DEPARTMENT OF ANTHROPOLOGY.

Address of F. W. Rudler on the Ethnology of Wales, p. 609.
On the Origin of the Malagasy, by C. Staniland Wake, p. 620.
On the Antiquities of Loughor Castle, by B. Jones, p. 620.
On Australian Autochthony, by W. Forster, p. 620.
On Drum-signalling in Africa, by Hyde Clarke, p. 620.
On a manuscript, perhaps Ghita, from W. China, by Hyde Clarke, p. 621.
Monosyllabism in philologic classification, by Hyde Clarke, p. 621.
The stone age in South Africa, by W. D. Gooch, p. 622.
An ancient settlement in the peat near Boho, Ireland, by T. Plunkett, p. 623.
On the structure of Round Barrows, Professor G. Rolleston, p. 623.
On the structure of Long Barrows, Professor G. Rolleston, p. 623.
Prehistoric times in the valley of the Rhine, Professor Schaaffhausen, p. 626.
The original Neanderthal skull, Professor Schaaffhausen, p. 626.
Palæolithic stone implement from Egypt, H. Stopes, p. 627.
Palæolithic flint instrument from Palestine, H. Stopes, p. 626.
A pocket registrator for Anthropology, F. Galton, p. 625.
On the Greek profile, J. Park Harrison, p. 625.
The flint-workers at Brandon, J. Park Harrison, p. 626.
Retention of prehistoric customs in the Pyrenees, Dr. Rhené, p. 627.
Color phenomena in Belgium and elsewhere, J. Beddoe, p. 629.
Precymric epoch in Wales, Hyde Clarke, p. 629.
Antiquity of gesture and sign language, Hyde Clarke, p. 630.
Surgery and superstition in Neolithic times, Miss A. Buckland, p. 630.
Bushmen Crania, Professor G. Rolleston, p. 631.
On the Salting mounds of Essex, H. Stopes, p. 631.
The Mountain Lapps, Lieut. G. T. Temple, p. 631.
The Hittites, W. St.C. Boscawen, p. 632.
A Bilingual seal in Cuneiform and Khita, Hyde Clarke, 633.
Prehistoric relations with gesture and sign language, Hyde Clarke, p. 635.
The Vei Syllabary of Liberia, W. Africa, Hyde Clarke, p. 635.
A Chilian tumulus, by John H. Madge, p. 636.
India the home of gunpowder on philologic evidence, Dr. G. Oppert, p. 936.

ANTHROPOLOGY IN BERLIN.—The Smithsonian Institution is in receipt of the Transactions of the Berlin Society of Anthropology, Ethnology and Prehistory, edited by Rud. Virchow. We infer that the society holds monthly meetings, since a separate pamphlet is devoted to each meeting, as follows: Feb. 21, March 20, April 17, May 22, June 12, June 19, July 17, Oct. 16. The greater portion of the papers are on home topics, but a few relate to America:

The preparation of arrow-poison by the Pai-Ute Indians of Nevada, by Dr. W. J. Hoffman.

Precolumbian Syphilis in America, p. 225.

Stone Implements from Yucatan, p. 237.

ITALIAN ANTHROPOLOGY.—The third fasciculus of the *Archivio* per l'Anthropologia e la Etnologia, furnishes the following additions to our knowledge:

Casi di anomalie numeriche delle vertebre nell uomo, by Dr. E. Regalia.

Ulteriori notizie intorno ai Negriti, by Professor Enrico Hillyer Giglioli.

These original papers are followed by reviews of Beccari's "Guide to the Mussulman pilgrimages and the Suez canal," Ramon Lista's "Los Charruas," Giovanni Pelleschi's "Republica Argentina," Ricardi's "L'Attenzione in rapporto alla pedagogia," Nicolosi-Tirrizzi's "Teschio umano Scafo-ultra-dolicacefalo-ortognato," Canestrini's "Anomaly of the Trentini cranium," and Moschen's "Studies in the cephalic and the nasal index." The journal is the official organ of the Italian Society of Anthropology, Ethnology and Compartive Psychology, and therefore, each number contains the minutes for one quarter.

THE AMERICAN ANTIQUARIAN.—The April number of the *Antiquarian*, Vol. III, contains the following papers:

An enquiry into the Identity of the Shawnee Indians. By C. C. Royce.
Ancient Stone Mounds.—Were they objurgatory burial heaps. C. H. Brinkly.
Inductive Metrology. W. J. McGee.
Tribal condition of the American races a clue to the condition of society in Prehistoric ages. By Rev. S. D. Peet.
Correspondence. On the Dakota language.—French footprints in northwestern Wisconsin.
Linguistic Notes (A. S. Gatschet). Wandot. Early Greek History. The Paez language. Thothmes.
Ethnologic Notes. General Reviews.

POLITICO-SOCIAL FUNCTIONS.—Science approaches man from many sides. While the physician directs his attacks against his animal organism, the philologist seeks to master the secret approaches to the source of speech, and the sociologist to surprise him in the very act of organizing his forces. Mr. Lester F. Ward, in the Penn Monthly for May, publishes in full a paper read March 15th, before the Anthropological Society of Washington, on Politico-Social Functions.

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GEOLOGY AND PALÆONTOLOGY.

The Temporary Dentition of a New Creodont.—The nature of the temporary dentition of the *Creodonta* has been hitherto unknown. As this point has an important bearing on the supposed relation of these animals to the *Marsupialia*, I give an account of it as seen in a new genus which has recently come under my observation:

Triïsodon quivirensis gen. et sp. nov. *Char. gen.*—Derived from the lower jaw. Probably only three premolars. True molars alike, consisting of three anterior cusps and a heel. The cusps are relatively small and the heel large. Of the former the internal is much smaller than the external, and the anterior is rudimental, being merely a projection of the cingulum. The cutting edges of the large external cusp are obtuse. The heel is basin-shaped, and its posterior border is divided into tubercles, of which the external is a large cusp. The fourth premolar has no anterior inner tubercle, so that the anterior part of the crown consists of a compressed cutting cusp. The heel has two well-developed posterior cusps. The third premolar has a similar principal trenchant cusp, but a smaller heel. Canines large.

This genus differs from *Herpetotherium* and *Ictops* in the simplicity of its fourth inferior premolar, and from *Stypolophus* and *Deltatherium* in the rudimental character of the accessory anterior cusps of the true molars, as well as in the three premolars. The rudimental anterior cusp of the true molars, with the three similar true molars, separates it from *Palæonyctis*, and the presence of a conic inner cusp of the same indicates it as different from *Amblyctonus* and *Periptychus*. It is not possible to state whether *Triïsodon* must be placed in the *Amblyctonidæ* or not, on account of the absence of the superior molar teeth.

This specimen of the type species of this genus is instructive as showing the succession of premolar teeth. Both the third and fourth premolars have temporary predecessors. The predecessor of the fourth premolar differs much from it in form, and is essentially identical in all respects with the true permanent molars. The crown of the predecessor of the third premolar is wanting, the roots only remaining in the jaw.

The permanent third premolar was protruded before the permanent fourth. Which temporary tooth of *Triïsodon* is homologous with the single one of the *Marsupialia* pointed out by Professor Flower?[1] As the additional permanent teeth of the placental *Mammalia* must have appeared later in time than the one already found in the implacentals, they must be those later protruded; hence the fourth tooth in the jaw of *Triïsodon* must be regarded as homologous with the fourth premolar of a placental, which is the last of that series to appear. If this be true, the tooth which follows the shed tooth of the Marsupials is not the fourth premolar, as supposed by Professor Flower, but the third premolar. This view is confirmed by the fact that the milk tooth displaced by the fourth tooth in *Triïsodon* resembles in all respects the true molars, just as the permanent tooth occupying the same position does in *Didelphys* and some extinct eocene genera. This goes to show that this tooth, permanent in marsupials, is temporary in placentals, and that, in spite of its form in the former group, it is the fourth premolar, and not the first true molar, as supposed by Professor Flower. Thus the posterior milk-molar of diphyodonts is a permanent tooth in the *Marsupialia*.

This observation confirms my conclusion that the *Creodonta* form a group intermediate between the *Marsupialia* and *Car-*

[1] Transactions of the Royal Society, 1867, p. 631.

nivora.[1] I may add that in *Triisodon* the inferior border of the lower jaw is not inflected posteriorly.

Char. specif.—Size about that of the wolf. Inferior canine directed upwards, its section nearly elliptic; a faint posterior, no anterior cutting edge. Fourth premolar rather large, with an anterior basal cingulum which is angulate upwards, and is not continued on the inner side of the crown. Cusps of the heel each sending a ridge forwards, the internal lower, obtuse and descending to base of inner side of large cusp; the external larger, with an acute anterior cutting edge continuous with the cutting edge of the large cusp. True molars with an external, but no internal basal cingulum. Border of heel with one large and three smaller tubercles, the former with, the latter without, anterior cutting edge. Enamel of all the teeth nearly smooth. All the cusps are rather obtuse. *Measurements.*—Length of inferior molar series: M. .080; long diameter of base of canine .013; length of true molar series .044; length of base of Prem. IV. .016; elevation of crown of do. .014; length of base of M. II. .016; width of do. in front .011. elevation of do, .014. The measurements of the jaw are not given, as the animal is not adult, the last molar not being yet protruded.

From the lower (? Puerco) Eocene beds of New Mexico.

Deltatherium absarokæ sp. nov. *Char. specif.*—This animal repeats very closely the characters of the *D. fundaminis*, but is much smaller in all its proportions. Both branches of the lower jaw accompany the anterior part of the skull, so that the dentition is well displayed. There are three inferior tubercular-sectorial molars, as in *Stypolophus*, but the fourth premolar has an internal tubercle, which is not found in that genus. The same tooth has a rudimental heel. The third inferior premolar is large, has a rudimental heel, and no inner lobe; the first premolar is two-rooted. There are only three inferior incisors. The superior molars are triangular, and the external posterior angle is not produced. The external cusp of the fourth posterior molar is compressed and simple, as in *Proviverra;* in *Stypolophus (Prototomus) viverrinus* and *S. multicuspis*, that tooth has a conic cusp and large posterior heel. The two posterior sides of the last superior molar are equal. Canines well developed. Enamel smooth.

Measurements.—Length of superior molar series: M. .0216; of superior true molars .0107. Diameters of second true molars: anteroposterior .0033; transverse .0055; width of jaws at same tooth .022; width between bases of canines .008; depth ramus mandibuli at Prem. I .005; at M. III .009. From the Wasatch Eocene of the Big Horn river; J. L. Wortman.—*E. D. Cope.*

A Laramie Saurian in the Eocene.—It is known that in North America the saurians of the Laramie formation are mostly

[1] See Proceedings American Philosophical Society, July, 1880.

Dinosauria, and that principally on this ground the formation has been referred to the Cretaceous series. A genus of uncertain affinity, *Champsosaurus* (*Simædosaurus* Gerv.), has hitherto been regarded as peculiar to the Laramie. In France, however, it has been found by Dr. Lemoine near Reims, in the Suessonian Eocene, associated with *Mammalia*. I am now able to announce that the same association occurs in New Mexico in a formation which lies below the typical Wasatoh Eocene, and which may be the Puerco. *Champsosaurus* is found imbedded in the same matrix with species of *Triïsodon*, *Periptychus*, *Hyracotherium*, and a species probably of *Phenacodus*. Portions of a dozen vertebræ were sent me, mingled with the teeth of the last-named mammal, and they appear to belong to one animal, and are unworn. As usual with vertebræ of the Laramie, the neural arches are lost. I describe the new species as follows:

Champsosaurus australis. Cervical vertebra distinguished by the superior transverse extent as compared with the longitudinal and vertical. The dimensions are about those of the *C. laticollis*. There is a similar median inferior low keel. The outline of the articular face for the neural arch is pyriform, the wide portion concave, with its external edge decurved. The decurvature is sometimes sufficient to resemble part of a rib-facet. Articular faces of centra nearly plane. Sides of centra very little concave, pierced by a foramen below the base of each diapophysis. Non-articular surfaces of centrum marked with a delicate thread-like sculpture. Diameters of cervical centrum: anteroposterior M. .012; vertical .014; transverse .017. Diameters of a dorsal: anteroposterior .013; vertical .012; transverse .015. The cervical vertebra is wider and more transverse than in either of the four known American species.—*E. D. Cope*.

Colors of Geological Maps.—Professor Renevier, of Lausanne, general secretary of the commission appointed by the Geological Congress of Paris of 1878, to unify the colors of geological maps, makes a report which is published in the Bulletin of the Vaudoise Society of Natural Sciences. Sub-committees were appointed in the following countries: Germany, Spain, Portugal, Russia, France, Italy, Switzerland and the United States. The fullest reports were made by the Italian and French committees, and the colors they suggest are as follows:

	Italian.	French.
A. Stratigraphic Series (colors pale).		
Modern beds	White	White
Quaternary	Pale green	Pale green
Pliocene	Clear yellow	Mars red
Miocene	Reddish yellow	Reddish yellow
Eocene	Bistre	Pale yellow
Cretaceous	Green	Green
Jurassic	Blue	Blue
Liassic	Violet	Violet

	Italian.	French.
A. STRATIGRAPHIC SERIES (colors pale)—*Continued.*		
Triassic	Burnt sienna	Burnt sienna
Permian / Carboniferous	Deep gray	Deep gray
Devonian / Silurian	Rose brown banded	Deep brown
Crystalline	Rose carmine	Rose carmine
B. ERUPTIVE SERIES.		
Granite	Deep carmine	Deep carmine
Porphyries	Saturn red	Orange yellow
Trachyte	Indian yellow	Indian yellow
Serpentine	Deep verdigris	Deep verdigris
Diorite	Deep blue	Deep blue
Melaphyre	Deep violet	Deep violet
Basalt	Deep bistre	Deep violet
Modern lava	Deep red	Orange red
Volcanic tufas	Very pale blue	Very pale blue

GEOLOGICAL NEWS.—Dr. Anton Fritsch's monograph of the Permian fauna of Bohemia, has advanced to the third part, including page 158. He describes the species of *Urocordylus, Ceraterpeton* and *Limnerpeton.* There are eleven plates and numerous phototypes in the text.——The annual distribution of the prizes of the Geological Society of London, at its annual general meeting, Feb. 18, 1881, was as follows: The Wollaston gold medal to Professor P. Martin Duncan, M.B, F.R.S., F.G.S.; the Murchison medal to Professor Archibald Geikie, F.R.S., F.G.S.; the Lyell medal for transmission to Dr. J. W. Dawson, F.R.S., F.G.S., of Montreal, by Mr. Worthington W. Smyth; the Bigsby medal to Dr. Charles Barrois, of Lille, to be transmitted by Professor Morris, F.G.S.; the remainder of the Wollaston donation fund to Dr. Ramsay H. Traquair, F.G.S., of Edinburgh, to be transmitted by Professor J. W. Judd, F.R.S., Sec. G.S.; the balance of the proceeds of the Murchison donation fund the president handed to Frank Rutley, F.G.S.; one portion of the moiety of the Lyell donation fund to G. R. Vine, Esq.; the second portion of the Lyell donation fund to Dr. Anton Fritsch, of Prague, by hand of Professor H. G. Seeley, F.R.S., F.G.S., for transmission.——The extensive silver ore deposit in South Western New Mexico recently examined by George Daly, proves to be of Middle Carboniferous age according to Prof. C. A. White. This palæontologist determines the following species as from the adjacent limestone: *Fenestella, Amplexus, Zaphrentis* and Crinoid species; *Orthis resupinoides* Cox; *O. ? michelini, Rhynchonella prolutosa* White.——A recent Cyprinid fish from China, having exactly the dental characters of the American Pliocene genus *Mylocyprinus* Leidy, has been recently described by Peters under a new generic name.

GEOGRAPHY AND TRAVELS.[1]

East Central Africa.—Mr. James Stewart, of the Livingstonia Mission, in a paper read before the London Geographical Society, gives the following account of the seasons and weather on Lake Nyassa:

"The year can be divided into only two seasons, the rainy and the dry. During the last week of October, when the sun is vertical, a few days of rain may be expected, but this is not the beginning of the rainy season. The rains usually begin about the 1st of December on Lake Nyassa. Further north, and at Pambete on Lake Tanganyika, they begin a month earlier, if my experience in 1879 was a usual one. Perhaps there the October rains really mark the beginning of the wet season. The rains last till April, sometimes even into the month of May. At Livingstonia, on Cape Maclear, the average rainfall is about thirty inches. Lying on a promontory jutting northwards into the lake, it is disadvantageously situated to catch the rain. Frequently heavy showers are seen passing down the east and west shores of the lake while Cape Maclear receives not a drop. At our sub-station at Bandawe, two degrees further north, as much as eighty-six inches of rain have been registered, and that in a season which the natives complained of as being too dry. Between May and October there very seldom is any rain. The soil gets dry and parched; the rank grass withers up and assumes the appearance of golden grain in England in July, only, however, to fall before the fiery storms which sweep across the country in September. This want of cold weather rains is a serious hindrance to agricultural operations. European cereals and vegetables cannot be raised without irrigation. In the dry plains of Northern India, Christmas rains and rains in February may be confidently looked for, and on them depends the success of the great wheat crop of the Punjab. Nothing corresponding to them is found in the Nyassa region of Africa.

"With the change of season a change in the direction of the wind occurs, or more correctly the latter is the cause of the change of weather. Winds from the north prevail from November to May, bringing with them the moisture-laden clouds from the Indian Ocean, while during the whole of the dry weather southerly winds prevail. The constancy of those winds is a source of trouble and expense to us. In May, for instance, it is easy and pleasant sailing to go to the north end of the lake, but to return in the same month requires a constant fight with the elements for ten days or a fortnight, taxing our courage as well as our seamanship.

"It is well known that the barometer in tropical countries is not subject to such rapid changes as in northern latitudes. At Livingstonia the annual range is only about half an inch, or from 28.20

[1] Edited by Ellis H. Yarnall, Philadelphia.

inches in November to 28.70 in June. The diurnal variation is rarely more than twenty hundredths of an inch. The barometer is therefore of little use as a weather glass, but, on the other hand, is more serviceable for geographical work in the measurement of mountain heights.

"The temperature on Lake Nyassa is very equable. The average midday temperature of the hottest month, November, is 85° F., and the average night temperature of the coldest month, May, is about 60°—a range of only 25° throughout the year. Occasionally, however, we have days at 95°, and even 100° has been registered once or twice. At the other end of the scale, 54° has been the lowest. As a general rule the wet-bulb thermometer stands at 10° below the dry-bulb throughout the dry months of the year."

As regards the alteration in level of the waters of Lake Nyassa, the observations made at Livingstonia show that "since 1875 the low-water level of the lake has year by year been falling, till in December, 1880, it was three feet below that of December, 1875. Should this decrease continue, the matter will soon become serious during the dry season with regard to the navigation of the southern end of the lake at the entrance to the Shiré, and still more so at the northern extremity of Lake Pamalombé, which, indeed, would probably soon become another marsh similar to Morambala; and the Upper Shiré, hitherto affording such a good waterway, would have its navigation interrupted by snags and sand-banks, while the *Ilala*, already requiring careful steering among the shallows, would be confined to the lake."[1]

As stated in our April number, the waters of the Tanganyika are falling since the opening of the outlet by the Lukuga. Mr. Thomson, of the recent expedition to these lakes, noticed a difference in the two mouths he passed on the shore of Tanganyika and saw a sill beginning to form at the mouth of the Lukuga. In ordinary seasons, Mr. Thomson thinks, "evaporation and rainfall balance each other, but that during some years there might be an excess of evaporation, which was a very likely thing to happen in such a country, and consequently the lake would fall in level. This clearly accounts for the intermittent character of the drainage. There had been a period of very dry seasons, probably before this century, in which the level of the lake was lowered so that no water went out by the Lukuga. Gradually a change took place; the rainfall became more abundant and the water gradually rose until the barrier was swept away and an outlet once more formed for the surplus water of the lake as they now had it."

Mr. Thomson's narrative of his journey has been published under the title "To the Central African Lakes and back," and contains much of scientific interest. He has a note on the recent great improvement in the climate of Zanzibar, the malaria and

[1] Livingstonia Mission Report for 1880.

general unhealthiness experienced there having practically disappeared; since 1857 the rainfall has diminished one-half and the island is now an ordinarily healthy one.

Botanical and conchological collections are treated of separately in an appendix. Mr. Edgar A. Smith, of the British Museum, states that the shells from Tanganyika indicate that "the lake was formerly an inland sea, whose waters have gradually freshened, many of the species having all the appearance of modified marine forms. Nyassa has apparently no connection with the formation of this lake, as it presents a quite distinct conchological fauna."

Of the geology of East Central Africa, Mr. Thomson says, that the coast tertiary deposits "are succeeded near the base of the inner plateau by sandstones and carboniferous rocks striking north and south, never rising over 1000 feet, and suggesting a continental outline unaltered from an anterior period. An immense series of greatly more ancient metamorphic rocks composes the escarpment of the plateau, after which a granitic district (sometimes decomposed and forming thick accumulations of clay) is reached, showing evidences of volcanic eruptions, which extended from the Cape to Abyssinia parallel to and near the coast. The upper plateau is also metamorphic, clay-slates occurring near Nyassa, round which is an extraordinary agglomeration of volcanic rocks, probably resulting from one slowly acting crater. No sufficient material is given for any broad sketch of the country between Nyassa and Tanganyika. The latter lake is set as it were in a socket of sandstone, which ends abruptly with the descent from the plateau, being succeeded by a great mass of felspathic rock forced through the crust of the earth previous to the formation of the present lake, and subsequently fractured into halves. The beds on the eastern side of the lake seem not to have been much disturbed, and were formed by a great inland sea-basin, which included the whole Congo region from Tanganyika to the West Coast mountains, the lake forming a bottom hollow, remaining salt on the upheaval of the continent. This basin disappeared through the channel cut by the great western outlet of the Congo, or by the more speedy fracture of the Zambesi."

The Algerian missionaries in Urundi, near the northern end of Lake Tanganyika, have founded a station on the west coast of the lake at Mulonewa in the Masansi country, on the shores of the large gulf which Stanley named after Capt. Burton. The country is covered with fine trees. A range of hills separates it in the rear from the Wabembe, who are said to be cannibals.

Père Livinhac, the head of the Algerian Missionary Expedition Uganda, has given some account of the rulers of that country. Under the *Kabaka*, or absolute monarch, are the chiefs of the great families, called *Mohamis*, of whom three members visited England in the company of missionaries who returned last year. Below these are a class of inferior chiefs. The lowest order are the *Wadu* or slaves. Mtesa is much under the influence of the *Mohamis*, who are mostly opposed to the admission of foreigners into the kingdom.

We learn from the *Mittheilungen* that Dr. Junker returned from his journey to the Monbuttu country to his station in Ndoruma's territory in December last. He crossed the Welle river half-way between Miani's Bakangoi and the former capital of Munza. Near the latter place he saw the grave of the Italian traveler. He returned through Wando's land, crossing the Gadde and Bibali rivers at their confluence. He finally departed from Ndoruma's on the 7th of January for Bakangoi and was last heard from at Pulembata in Baria's country on January 28th.

West Central Africa.—Dr. Max Buchner failed in his effort to explore north of the kingdom of the Muata Yanvo. He only reached lat. 7° 22′ S., when the desertion of his porters obliged him to return. He arrived at Malange on February 8th. Most of his collections were on board of a steamer recently lost in the British Channel.

Dr. Pogge, whose visit to the Muata Yanvo six years ago will be remembered, has arrived at St. Paul de Loanda and departed for Dondo.

Herr Flegel, whose trip up the Binué was described in the Naturalist for September, 1880, has recently been visiting the unknown course of the Niger between Jauri and Say. He found navigation obstructed and frequently rendered impossible by beds of immense boulders, through which the stream forces its way with immense difficulty.

On the Congo some advance has been made by the missionary parties in their progress towards the interior. Mr. McCall's party has safely reached Manyanga, near the right bank of the Congo, above the Yellala falls. This mission has now five stations in the first 200 miles on the Congo, viz.: Banana; Mataddi Minkanda, opposite H. M. Stanley's station at Vivi; Paraballa; Banza Montega; and Manyanga, which is situated a few miles inland from the northern bank of the Congo. Another station is to be established at the mouth of the Edwin Arnold river, some miles higher up than Manyanga. Mr. McCall has determined to proceed to Stanley pool by the river, believing that many and perhaps the majority of the intervening falls and rapids can be passed in canoes. He has already passed one, the Ntombo Mataka falls of Mr. Stanley's map.

Meanwhile the members of the Baptist Missionary Expedition, Messrs. Crudgington and Bentley, have succeeded in reaching the pool by following the north bank of the river. After a journey of twenty-one days they arrived at Mfwa, near Mankoneh's village at Stanley pool. From here they crossed the pool to Ntamo or Kintamo, where they remained two days, but finding that the natives did not wish them to stop, they went on by land to Nehasha or Kinshasha, where the natives were even worse, owing probably to a misunderstanding. This appears to be the locality of M. de Brazza's station, and notwithstanding all that the French sergeant in charge said, the natives, finding that Mr. Crudgington and his companions were not Frenchmen, could not be persuaded that they were not enemies. They accordingly made the best of their way back to the opposite side of the river and shortly afterwards commenced their return journey, which was accomplished in fifteen days, partly by land and partly by water.

The expedition now proposes, after consultation with Mr. Stanley, to use his road as far as Isangila, his furthest station, thirty miles above Vivi, and then to place a steel boat on the river above the falls at that point. It is hoped that the navigation will be uninterrupted above Isangila, except at two or three places where the boat will have to be taken round the cataracts. Mr. Stanley himself contemplates adopting this course also, as above Isangila is a very troublesome tribe, named Basundi. He has a steam launch and two steel whale-boats above the falls. He is now awaiting the arrival of a reinforcement of seventy-two natives from Zanzibar.

Mr. Richards, of the Livingstone (Congo) Inland Mission, has recently visited two towns, a short distance from Banza Montiko, where no Europeans had hitherto been. One of them he describes as neat and orderly in its arrangement. He heard of others further on and thinks the population of the district larger than was supposed. The people are intelligent but very shy.

GEOGRAPHICAL NEWS.—The June number of *Petermann's Mittheilungen* contains a valuable paper by Dr. Herman Ziemer, on the greatest daily rainfall. Four inches of rain in twenty-four hours have been recorded at Breslau, Brussels, Geneva, Trieste, Milan and Genoa. Verviers heads the list of European towns with fourteen inches. Purneah, Bengal, has had thirty-five inches. In the British Isles the greatest registered is 12.5 inches at Portree, in the Isle of Skye.——The Royal Geographical Society have published a General Index to the fourth set of ten volumes of the Society's *Journal*. Also a classified catalogue of the collection of maps. A second supplement to the catalogue of the library will include additions to the end of 1880.——The engineers engaged on the Panama canal find great difficulty in deciding how to treat the Chagres river. An immense dam is proposed to turn the river into a lake with an outlet to the Pacific, but the task would be a gigantic one. The dam would have to be a mile long, over 1000 yards thick at the bottom, 250 at the top, and some 50 yards in height.——A narrative of the journey of Count Bela Szechenyi through India, Japan, China, Tibet and Burmah, by his companion, Lieut. G. Kreitner, is to appear in thirty parts, illustrated with wood-cuts, maps, etc., and published in Vienna.——Capt. J. E. Sandeman, of the British Indian Survey, has recently sent out a trained native explorer to endeavor to ascertain the source of the Irrawaddy river. He went up the stream in boats to Kacho, lat. 25° 20′, at an elevation of about 1000 feet above the sea. Thence by land he continued on to Mogungpoon Maingkung, lat. 26° 8′, at which place the exploration terminated. The eastern and western branches meet at Ponk-san-poon; the western branch is the largest and is said to rise in the Kanti country. There seems to be no doubt that there is no longer any reason to suppose the Irrawaddy is connected with the Sanpu river of Tibet.——The *Academy* says there are several expeditions preparing to visit the Obi and Yenisei gulfs this season. M. Siberiakoff is fitting out sledges to take supplies to two of his vessels which have been frozen up in the Gulf of Obi during the winter. The steamer *Nordenskiöld* will sail for the mouth of the Yenisei from Gothenberg. A hydrographic expedition is also being formed in Russia to visit the Sea of Kara and Gulf of Obi.

MICROSCOPY.[1]

THE BLOOD IN HIBERNATION.—In the autumn of 1879, Professor V. Wittich, received twelve living German moles *(Mus montanus)*, in order to investigate the amount of glycogen in the liver during their winter sleep. One animal was killed accidentally immediately after its arrival, and the results obtained on a microscopical examination of the blood, led to an examination of the blood of the other animals, all killed in perfect health, and in all the same appearances were found. One of the animals had died on the journey without signs of disease, although perhaps in consequence of a bite from another animal.

The blood taken from a vein in the peritoneal cavity contained a large number of thread-like moving objects, which moved the blood corpuscles lying near them, and, after diluting the blood with a-half per cent. solution of chloride of sodium, presented an appearance identical with that of the spermatozoa of the frog. These organisms appear to be the same as those described by T. R. Lewis as existing in the blood of healthy rats. They are much larger than the spirilla met with in the blood of relapsing fever. They were found in the blood from various parts, arterial and venous, in every animal. They disappear from the blood as soon as decomposition sets in and the putrefaction-bacteria appear. They were very numerous, ten or twelve being found in every drop of blood, and they furnish a new proof of how large a number of parasitic organisms may exist in the blood without causing any disturbance to the general health. Attempts were made to inoculate guinea-pigs, but in every instance with a negative result.—*London Lancet.*

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

Mounting Starches.—A correspondent of *Science Gossip* advises to mount starch by dredging it through muslin into balsam melted in a test tube over a spirit-lamp. After the air bubbles which will appear have been caused to burst, a little of the balsam is transferred to a slide and covered with a warmed cover-glass, when the starch it contained is found to be evenly distributed, free from air bubbles, and in suitable condition to be viewed by polarized light. Very soft balsam, which requires but little heat, should be used in this procedure, lest the starch grains should be altered by the heat.

New Microscopical Journal.—The microscope, and its relations to medicine and pharmacy, is the title of the new journal whose publication has been commenced at Ann Arbor, by Professor Charles H. Stowell of the University of Michigan. It is a bi-monthly of thirty-two pages, primarily of a microscopical character, but introducing a considerable medley of medical and pharmaceutical notes. Though very elementary in its character, and designed essentially for beginners, it is sensible and scientific in its tone, and will therefore be of interest to all. The pharmacy department is under the charge of Mrs. Louisa R. Stowell, whose real ability and previous good work in this direction give assurance that her department will be an important as well as prominent feature of the enterprise.

Recent Pamphlets.—Les apparences microscopiques des Valves des Diatomees, par Julian Derby, C. E. Bruxelles, Belgium.

Etudes sur des Coupes de Diatomees (Jutland), par W. Prinz. Bruxelles, Belgium.

On some Impurities of Drinking-water. By Professor W. G. Farlow, Boston.

The condition of the Brain in Insanity. By Theodore Deecke, Utica, New York.

Pseudo Polypi of the Colon. By Surgeon J. J. Woodward, U. S. A., Washington.

Society Notes.—The American Society of Microscopists will hold its fourth annual meeting at Columbus, Ohio, commencing on the 9th of August, under the presidency of J. D. Hyatt, of New York. A full and interesting meeting is expected. The local arrangements for reception and entertainment under the auspices of the Tyndall Association of Columbus, will doubtless be of the most satisfactory character.

The American Association for the Advancement of Science, meets at Cincinnati on Wednesday of the following week, August 17th, the subsection of microscopy being under the chairmanship of Rev. A. B. Hervey of Taunton, Massachusetts. During the week of the meetings, the Department of Science and Art of the Ohio Mechanics' Institute, will open a loan exhibition of scientific apparatus, including microscopes, and other optical instruments. It is believed that this exhibition of apparatus and objects illustrating natural history in its various branches and applications, will add greatly to the interest of the meetings. Among the prizes offered are the following: Gold medal for the best display of microscopes and accessories; silver medals for the best display of optical apparatus, of magic lantern and apparatus for projection, and of microscope slides in set of not less than fifty slides; and honorable mention for the best microscope stand, best object glass, and best polarizing apparatus.

The Rochester Microscopical Society, after an existence of two years, during which time it became the largest organization of the kind in this country, has drawn around it sections in other departments of science, and has thus given origin to a new society of wider scope, the Rochester Academy of Science, of which it will hereafter be a section. The recent annual reception of the new academy was one of the largest and best of such entertainments that have been given in the country.

The ninth annual reception of the San Francisco Microscopical Society was distinguished by the scientific value of the objects selected for exhibition, and by the large and appreciative assemblage of guests. The concourse of friends was said to be the largest that has ever attended a reception of the society.

The exhibition of the Wellesley College Microscopical Society, was remarkable for the thorough scientific character and direct educational value of the exhibits. The microscopical work at this institution is evidently well planned and well executed.

The thirteenth annual field-meeting of the Troy Scientific Association, held at Trenton Falls, N. Y., was one of the most successful out-of-town meetings ever held by this society. A large and distinguished party of members and friends enjoyed the rare social advantages and scientific opportunities of the trip.

The Oneida County Microscopical Society has been organized, under the presidency of Professor A. H. Chester. It meets at Utica, N. Y.

The American Postal Microscopical Club has just completed the first year's work since reorganization. Postal troubles are no longer experienced, and with rare exceptions the working of the circuits has been satisfactory. The boxes have been called in for the summer, but will be started again in September or October.

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SCIENTIFIC NEWS.

— A remarkable cave has been discovered in the Santa Rita mountains, Arizona. For several years the existence of a curious cave near Graterville has been known to the miners of the vicinity, but the difficulty of thorough exploration has deterred many from visiting it, and half of its wonderful extent is as yet unknown. From P. J. Coyne, a well-known and reliable prospector, who is in the city, in company with Mr. Johnson, a *Citizen* reporter, were gathered some interesting facts, the result of a partial exploration.

The cave, which is known by the miners as the Aztec, is located about four miles south of the Graterville placers, in a limestone ridge. Quite recently a party of miners numbering eight or ten, including Mr. Coyne, explored seventeen rooms in all, the corridors and approaches to which extended for nearly a mile from the entrance.

The cave has two entrances, which lead into an oval cavity, thence a corridor leads into a large room, and thence into a still larger. In from the latter are two smaller cavities, and these comprise the extent of former explorations. In them have been found at various times in the past relics of Indian occupation, including arrows and skeletons. In one place several Indian skeletons were found in a depression in the floor of the cave, evidently fashioned by human hands. This latter room is described as being of marvelous beauty. It is irregular in shape, and is full of all the various forms which the action of lime has the power to create. In one of these rooms is a group of almost perfect statuary. It consists of a large block of limestone in the shape of a man, woman and child, the man being in the center, and also having the closest resemblance to humanity. The head is especially like that of a man, having the features almost distinct and surmounted by a hat. A short distance away from the group, in the flickering candlelight, the illusion is said to be absolutely perfect. At this point the cave discloses the strange feature of being two-storied, to reach the lower rooms of which it was necessary to descend by means of ropes. Here the extent of the old exploration cease, and the adventurers had to be careful lest some new and strange feature of the cave cause them trouble. In one of a group of three lower rooms was found a huge stalactite, which was instinctively called Pompey's Pillar. It is three feet in diameter at the base, and lessens gracefully in size to the roof of the cave, thirty feet high. This is probably 600 feet below the surface.

From the rooms last mentioned a corridor leads to a very large and irregular cavity, and from this small corridors lead to very beautiful rooms, which were given the names of different members of the exploring party. The one named for Mr. Coyne is the largest in the cave. From what was called "Hale's room" the party followed a steeply inclined tunnel seventy-five or eighty feet long, which terminates in a large abyss sixty or seventy feet in diameter. After lowering one of the party down the perpendicular sides from the mouth of the tunnel as far as the remaining rope would permit—about seventy feet—and failing to find bottom, the explorers named it the "bottomless pit."—*Tucson Citizen.*

— What is equivalent to a well sustained, energetic and truly scientific biological survey of Illinois, is now being carried on by the Director of the State Laboratory of Natural History, at Normal, Illinois. The appropriations for the year ending June 30, 1880, were $4000, and when it is remembered that the State has besides a salaried entomologist, it must be conceded that Illinois is leading all the States in the Union in biological work well calculated to elevate, educate and inform the masses. Professor Forbes' able contributions, as well as those of his assistants, have from time to time been noticed in this journal. He is now carrying on the field work, the State being divided into four or five regions. In the appropriation bill passed for the coming year, special provision is made for field work in zoölogy, for field work in botany, for the supply of series of the plants and animals of the State, to the State Museum, the State educational institutions and the public high schools, for the investigation of the food of birds, of the food of fishes and of the parasitic plants and animals of the State, for the improvement of the library and for the publication of bulletins of original work. The laboratory has accumulated the largest collection of fungi in the Western States, the collection embracing 550 species of Illinois, 1000 United States species and 1500 species foreign fungi.

Our readers will see that these subjects are so distributed as to cover directly and indirectly nearly the whole field of the natural history of Illinois.

— The Zoölogical Society of London has, we learn from *Nature*, established an insectarium, or series of rooms for rearing insects in captivity. The building for this purpose is constructed of iron and glass on three sides, with a brick back to it; the cases containing the insects are arranged on stands all round the building, and also occupy two tables in the center. The cases used for the principal specimens are formed of zinc plates. The upper part of these is glazed on all four sides, the top being formed of perforated zinc, so as to admit the air. The larger cases in the front row measure about 24 inches in breadth by 18 in depth, and are 32 inches in height. The cases in the opposite row are of similar construction, but rather smaller in dimensions. The whole series of insects already on exhibition last spring comprised about fifty species, among them the Cecropia moth and *Samia gloveri* of the United States. Every specimen in the insectarium is distinctly labeled, and over each of the principal cases is fixed a glazed box, in which are placed preserved specimens of the various stages of metamorphosis of the insect exhibited in the case beneath.

— The tendency in our colleges is more and more towards the cultivation of the sciences of observation, to found separate chairs of natural history, and not to require a single professor, as of old, to teach physics and chemistry, as well as geology and biology. In proof of this statement, we notice that Hon. John P. Howard has endowed a professorship of natural history in the University of Vermont. The fund of $50,000 thus given to be applied in part for museum and library purposes. At Brown University, Mr. W. W. Bailey has been appointed Olney professor of natural history, the duties being instruction in botany. A generous friend of the University is also providing a roomy laboratory, lecture room, study and store room for the use of the professor of zoölogy and geology. At Bowdoin College, Mr. Leslie A. Lee has been appointed professor of geology and biology. Dr. S. F. Clarke, late Fellow of Johns Hopkins University, has been appointed professor of natural history at Williams College; an appointment for which the College is to be congratulated.

— Professor Cope's expedition to Paraguay, known as the American Naturalist Expedition, left New York for Para, May 1st. The survey has a wide scope, covering many of the natural features of the regions to be examined. It is under the direction of Mr. Herbert H. Smith, formerly of the Geological Survey of Brazil, under Professor C. F. Hartt, and the author of a scientific volume on Brazil, published by the Scribners. The expedition is the individual effort of Professor Cope.

Mr. Smith will act as regular correspondent to the NATURALIST, describing the regions explored. We anticipate that his notes on the fauna and flora will be particularly interesting. The survey is fully equipped with means to preserve a full supply of material, which will be utilized upon reaching Philadelphia, and will throw much light on some little known regions of South America.

— Holt & Co., of New York, have in press a book entitled The Structure and Life-histories of Butterflies, by S. H. Scudder. It relates particularly to American butterflies, and is mainly a reproduction of lectures given several years ago before the Lowell Institute. It deals with the general problems suggested by a study of the structure, development, seasons, distribution and coloring of butterflies from an evolutionary point of view, and will discuss more fully than has heretofore been attempted, the ancestry of this group of insects. Nearly three quarters of the two hundred illustrations have been prepared for the work, while the others are borrowed principally from Harris and Riley.

— A work of extensive anatomical research on the cerebellum in various animal species has been conducted recently by two Italians, Drs. Tenchini and Staurengi. From a résumé of it in the *Archives des Sciences*, we gather that it establishes three important features as the exclusive possession of man, viz., the valves of Taria, a new tubercle in the arch of the fourth ventricle, and the ventricle of Verga. These are considered characters of prime importance as being related to the nervous system; and with others, they show, that if the anthropoid apes are the vertebrates nearest to man, the distance between man and the ape is still very great.

— A paper was read at a recent meeting of the Chemical Society on the action of compounds inimical to bacterial life, by

Mr. W. M. Hamlet. The cultivating fluids used comprised Pasteur's fluid, beef-tea, hay-infusion, brewer's wort, and extract of meat; these were sterilized by boiling for ten minutes in Pasteur's flasks, cooled with suitable precautions, and then seeded with hay solution and the substance under examination added. Many gases, &c., were tried. Chlorine and hydric peroxide were fatal to bacteria, while chloroform, creosote, carbolic acid, salicylic acid, &c., hindered their development, but did not destroy them.

— The appointment, by President Garfield, of Hon. George B. Loring as Commissioner of Agriculture, has been regarded on all sides as peculiarly fitting. It is a new departure to have a commissioner who is not only a gentleman of broad culture, but one who sympathizes with scientific men, and will, undoubtedly, encourage, as no former commissioner has done, the development of applied botany and zoölogy, particularly entomology. As an earnest of his intentions in this direction, the commissioner has appointed Professor C. V. Riley entomologist of the department, in place of Professor Comstock, resigned.

— We learn from the *Nation* that the International Congress of Americanists will be held at Madrid, Sept. 18–22. The first day will be devoted to American geology, the history of Precolumbian times, and the history of the discovery; the second day to archæology; the third to anthropology and ethnography; the last to linguistics and palæography. The general secretary is Captain C. F. Duro Sauco 13 duplicado, Madrid. The programme, list of officers, delegates, etc., has been issued by M. G. Hernandez, of Madrid.

— We have received Bulletin 4 of the Illinois State Laboratory of Natural History, comprising a catalogue of the birds of Illinois, by R. Ridgway. This list will be of use in the more important biological work carried on in this institution, which is a great credit to the state, and will do much to turn naturalists away from "species work" and induce them to study the relations of animals to one another, and to their physical surroundings.

— The International Geological Congress is to hold its second session at Bologna, commencing on Sept. 29, 1881. The King of Italy has offered a prize of 5000 francs for the best suggestion for an international scale of colors and conventional signs practically applicable to geological maps and sections, including those of small scale. The competitive papers were demanded by the end of May.

— Near Lützen, in Saxony, a number of sepulchral urns have been discovered in a brickfield, and accompanying them skulls and bones, showing that cremation and burial were both practiced by the depositors. Professor Virchow says that one of the skulls he has examined resembles the Neanderthal skull, but differs sufficiently to form a type of its own. No ornaments were discovered.

— Mr. Charles Darwin's work entitled "The Formation of vegetable Mold through the action of Worms, with Observations on their Habits," and the life and letters of the late Sir Charles Lyell, Bart., edited by his sister-in-law, Mrs. Lyell, are announced by Mr. Murray.

— It was probably before Carlyle mollified his views concerning evolution and science, owing possibly to the influence of his friend, Professor Tyndall, that he paid his respects to the theory in the following terms: "I have no patience whatever with these Gorilla Damnifications of Humanity!"

— The Italian government is about to send out a deep-sea expedition to explore the Mediterranean, Prof. Giglioli, the eminent zoölogist of Florence, having charge of the biological part of the work.

— The translations of Nägeli and Schwendener's Treatise on the Microscope is approaching completion. It will be issued by Sonnenschein & Allen, of London.

— English science has met with a great loss in the untimely death of Professor George Rolleston, F. R. S., of Oxford University, who died at his home June 16th, at the comparatively early age of 51 years. Professor Rolleston was, to those who knew him, a most genial, attractive and cultivated man, aside from his thorough scientific spirit and training. He was the author, besides of a number of anatomical and anthropological papers and memoirs, of a comparative anatomy for students, entitled, "Forms of Animal Life." Professor Rolleston first introduced, if we mistake not, the plan of giving detailed accounts, with excellent illustrations, of typical forms of animal life. The death of Professor Rolleston will be deeply mourned by those American scientists who were fortunate enough to have met him at his museum and also at his pleasant English home.

— Another English naturalist, Mr. John Blackwall, died May 11, at the great age of ninety-two. He was the author of a beautifully illustrated folio work on British spiders, and of a number of zoölogical papers.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Davenport Academy of Natural Sciences.—Annual Meeting. Our report of the annual meeting of this flourishing society has been delayed for want of space. We give extracts from President Pratt's report as to the part taken by the Society in American archæology, especially as related to the mound-builders.

The mound-builders were very numerous throughout the Mississippi valley. They dwelt mostly, if not exclusively, in the neighborhood of the rivers. They were a people entirely distinct from the North American Indians, as we know them, had occupied the country in much earlier times than the latter, and were entirely unknown to them, even by tradition.

Like the modern Indians they were of different tribes; but less warlike and less nomadic, more domestic in their habits; yet their dwellings must have been of the most imperfect and perishable character, no traces of them being found.

They practiced cremation, though but to a limited extent, and only upon great and unusual occasions.

They lived in a very simple manner, possessed few mechanical contrivances, but were a laborious, pains-taking people. That they had some system of barter with neighboring tribes at least (though perhaps limited to mere occasional exchanges as opportunity offered) is shown by the occurrence in the mounds of large sea shells, which, at the nearest must have come from the Gulf of Mexico; obsidian which must be from the far west, mica, not to be found in this region; galena, &c.

Copper was evidently a rare and highly valued article among them; its rarity seems to indicate that they at least did not work the copper mines of Lake Superior or anywhere, and were not much in communication with any people who did.

Small nuggets of drift copper are still occasionally found here, we have several in our museum, picked up in this vicinity; and a numerous people dwelling here for a long period would be likely to find the greater portion of all such specimens existing here, and if they did so, that would furnish a quite sufficient source of supply of material for all the copper relics yet discovered without the necessity of drawing upon the mines. That the mound-builders had no knowledge of the art of smelting is well shown by the following facts:

The numerous copper axes, awls, beads, &c., and the very rare silver ornaments are evidently of the pure native metal and *hammered*, none are found bearing the slightest indications of having been melted; no molds or crucibles, or fragments of any have ever been found, although they would be of the most imperishable character, more so even than the pottery which is exceedingly common.

If cast in molds, many would be made of identical size and form, whereas no duplicates are ever found.

If, as has been argued, though I believe on very insufficient grounds, the copper implements collected in Wisconsin exhibit indications of having been formed in molds, it would have no bearing whatever upon the origin of those of Iowa, which are of very different type; those of the north being mostly of the more modern forms of spears and knives; and not unusually found in mounds, but scattered on the surface or in the shallow Indian graves.

The copper "axes," so called (and very inappropriately, too), in no instances show any indications of having been put to any use as tools, or even of having had handles attached. They were doubtless valued and kept as badges of rank or wealth, and held in high esteem.

Those people undoubtedly smoked tobacco, not, however, as a recreation or habitually for pleasure, but as a kind of ceremonial observance. The pipes are often very elaborately and beautifully carved out of a great variety of kinds of stone, generally of a rather soft character, and were apparently held in very high estimation, perhaps almost sacred. They are all in the Upper Mississippi Valley, of the same general type, having the flat, curved base, which is perforated to serve as a stem and not at all adapted to retain in the mouth for smoking continuously; which fact, with the smallness of the bowl itself, would indicate that it was to be used by passing from one to another of the persons assembled.

They represent a great variety of animal forms, some difficult to determine, but among them are two, well and distinctly representing the elephant, though differing somewhat from each other in form and position. These plainly and unmistakably show that the sculptors were acquainted with the elephants (the mammoth or mastodon), of which, though long extinct, numerous remains are found throughout this country.

Strangest of all, and most contrary to the opinion of archæologists hitherto, it now appears that *the mound-builders had a written language.* Whence derived, or what its origin is matter of the merest conjecture. What its affinities, or whether any connection with other written languages, ancient or modern, no one has as yet been able to determine.

The inscribed tablets in our museum, the only ones of much significance or importance perhaps, which have as yet been discovered in the mounds, have attracted much attention both in this country and in Europe, and by all eminent and well informed archæologists, are considered of the highest importance. They are certain to stimulate research, which will doubtless lead to further discoveries, until it may well be hoped that the key to the language may ultimately be discovered, and something of a history of this ancient people may be made out as written by themselves.

Whether the language was understood by all, or only by a more learned few, or whether these tablets were heirlooms and cherished relics, cannot now be scarcely even guessed.

A rather significant circumstance, perhaps, is the fact that in the same mound with the two tablets first found, were the bones of a young child, partially preserved by the contact of a large number —about 300—copper beads, indicating it to be an important personage, and that persons of high rank were buried there.

Some doubts of course have been expressed regarding the genuineness of the tablets, though not to any great extent by competent and candid archæologists, and we feel no uneasiness on that account.

The tablets have been sent to the Smithsonian Institution for examination, and were retained there and subjected to the most thorough scrutiny for two months, during which time the National Academy of Sciences held its meeting there, and the heliotype plates of them were obtained under the directions of Professor Baird himself. They were also exhibited throughout the sessions of the meeting of the American Associations for the Advancement of Science at Boston last August.

Any author or other person who cared to inform himself of the facts, has, and has always had ample opportunity to do so, and would at once see that the circumstances of the finding were such as utterly to preclude all possibility of fraud or imposition.

The evidence that they are coëval with the other relics, that is, that they were inhumed with them and before the mound was built, is ample and conclusive and will be so considered by any unbiased mind.

No prehistoric relic ever found has better evidence to establish its genuineness than these, and not one suspicious circumstance in connection with them has been pointed out, nor can there be.

We shall confidently hope for and gladly welcome further discoveries by whomsoever made tending to throw more light upon this still obscure and intensely interesting problem, of our earliest predecessors on this continent.

Among the principal additions to this department of the museum since the last annual report, have been fourteen mound-builders' pipes, three copper axes, and a number of other relics from the mounds, secured chiefly by the untiring exertions of our honored associate, the Rev. Mr. Gass, who has spared no time or labor, and who has recently presented his report of the exploration of 75 mounds within the year, only one-fifth of which afforded any relics for the museum, though the investigations are always instructive, and many facts are thus learned.

Besides this gratuitous labors and personal expenses borne by himself, about $70 made up by private contribution has been expended for hired help in opening the mounds; the results have been highly satisfactory; and this important work should be continued, and, if possible, better provided for by some regular appropriations. The time is rapidly passing during which the opportunity for such researches in this vicinity will remain.

We have also received as the product of the persistent enthusiasm of Capt. W. P. Hall about 1100 ancient stone and flint implements, and 150 vessels of ancient pottery, the latter having been exhumed by his own hands from the mounds and ancient burial places of the lower Mississippi valley.

Our collection of mound relics now consists of the four inscribed tablets, 32 mound-builder's pipes, 25 copper axes, 300 copper beads, 14 copper awls, and a great number and variety of other relics from the mounds of this region, constituting the most extensive, rare and unique collection of its kind in this country and probably in the world.

Besides these, this department contains 225 vessels of ancient pottery, over 1000 stone implements, and 10,000 of flint, beside about an equal number of broken ones and fragments worth preserving.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

American Journal of Science, July.—Restoration of *Dinoceras mirabile*, by O. C. Marsh. Observations on the structure of Dictyophyton and its affinities with certain sponges, by R. P. Whitfield. Later Tertiary of the Gulf of Mexico, by E. W. Hilgard (with valuable colored map). Turquois of New Mexico, by B. Silliman.

Geological Magazine, June.—Subsidence and elevation, by J. S. Gardner. The mammoth in Europe, by H. H. Howorth.

Annals and Magazine of Natural History, May.—Male eels compared with the females, by C. Robin.

June.—On the originally bilateral character of the renal organ of Prosobranchia, and on the homologies of the yelk-sac of Cephalopoda, by E. R. Lankester.

Archiv für Mikroskopische Anatomie, March 8.—On the distribution of phosphorescent organs in fishes, by B. Solger.

Zeitschrift für wissenschaftliche Zoölogie, June 14, 1881.—The structure of the stigmata in insects, by O. Krancher (elaborately illustrated). Revision of the Holothuria of Mertens-Brandt, by H. Ludwig. On fish psorosperms, by O. Bütschli. Studies on the Bopyridæ, by R. Kossmann.

Annals des Sciences Naturelles, February.—On a new and very small species of Crocidura from Madagascar, by M. Trouessart. Memoir on the birds of the family Megapodiidæ, by M. Oustalet. Memoir on the disposition of the cervical vertebræ in the Chelonians, by L. Vaillant.

Canadian Entomologist, June.—Description of the preparatory changes of *Papilio palamedes* (calchas), by W. H. Edwards.

Psyche, organ of the Cambridge Entomological Club, January.—On the number of molts of butterflies, with some history of the moth, *Callosamia promethea*, by W. H. Edwards.

Papilio, organ of the New York Entomological Club, June.—On *Pieris bryioniæ*, and its derivative forms in Europe and Asia, by W. H. Edwards.

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VARIATIONS IN A COPEPOD CRUSTACEAN.

BY CARL F. GISSLER, PH.D.

IN March, 1878, a large, deep pond near Glendale, Long Island, was found densely populated with blood red Copepod Crustaceans, which, microscopically examined, proved to be a form slightly aberrant from *Diaptomus sanguineus*, described by Professor S. A. Forbes,[1] who figured its inferior and superior maxilliped and fifth pair of legs of the male and female.

The Long Island form[2] is unquestionably the same species as that from Illinois, but the climate and locality have effected slight morphological changes of those organs which in Copepod Crustaceans are most liable to occur. The differences noted between the individuals from the two localities are, however, very trifling, and its elevation to the rank of a new species would not be advisable. It appears, as in so many other instances, that careful examinations of a species from different localities do not demonstrate the constancy, but the evolution of the same. The changes sometimes concern insignificant structures, but often also the most important parts used by the systematist in describing a species.

To make the study of Copepods[3] in general, better understood to the amateur, I have more thoroughly described and figured all their external structures.

The body of Copepoda is more or less distinctly segmented and

[1] Bulletin of the Illinois Museum of Natural History. No. 1. List of Crustaceans, with descriptions of new species, by S. A. Forbes, 1876.

[2] Measures 3mm. in length.

[3] Consult also "Die freilebenden Copepoden," by Professor Dr. C. Claus. Leipzig, 1863, page 200.

distinguishable into regions, with two pairs of antennæ, the anterior pair much larger, either one or both of the latter often transformed into an auxiliary, prehensile, copulative organ. They possess neither a carapace nor a bivalve shell; but have three pairs of mouth-parts and five pairs of swimming feet. Females with external egg-sac.

Family of Calanidæ.—Body elongate, similar to that of Pontellidæ, anterior antennæ very long, usually of twenty-four to twenty-five joints. In the male sex the right, rarely the left antenna is transformed into a geniculating, prehensile organ. Posterior antennæ comparatively large, two-branched. Mandibulary palpus two-branched, similar to the posterior antennæ. Maxillæ with a large, manifold-lobed palpus. Maxillipeds powerfully developed. Fifth pair of legs large, either similar to the four preceding or alike in both sexes, or aberrant from those and dissimilar in the sexes; in the male a clasping organ to assist, together with the right antenna, in copulation. Heart present. Eyes highly developed, median and mobile. Male genital glands unpaired, female glands paired. Single median egg-sac of orbicular shape.

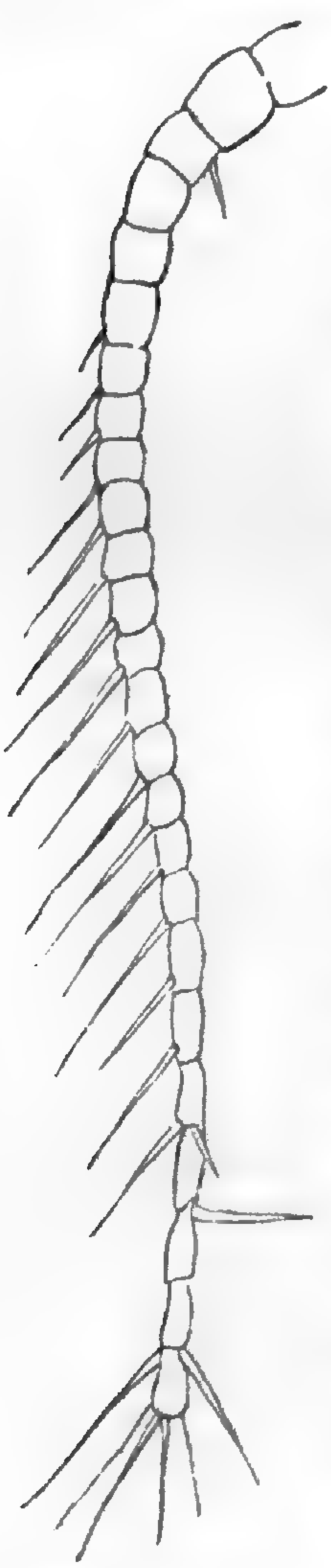

FIG. 1.—Left anterior antenna of male.

We now drop some live specimens into alcohol; they will die in a few seconds; leaving these crimson colored little Crustaceans in alcohol for some time, they will soon become pale and finally yellowish, transparent. We now pour off the alcohol and add a strong solution of pure carmine in concentrated ammonia and a little glycerine, macerating them for about one day. Then we wash the staining liquid gradually off, first with water and then with alcohol, and preserve them in glycerine for examination.

Placing a male specimen (Fig. 4) on a glass slide under the dissecting microscope with low power, we now proceed with the dissecting needles to separate successively the different appendages, viz., the anterior long antennæ, the shorter posterior antennæ, the mandibles with palpus, the superior maxillipeds, the maxillæ, the inferior maxillipeds, the four pairs of natatory legs, the fifth, transformed pair of legs, and finally the abdomen with the terminal furca. Viewing the remaining "carcass" from which those appendages have been taken, we will notice that there is a certain demarcation between head and thorax, forming a segment; following this we find five more thoracic segments, of which the fifth is half as long as either the second or third, the fourth slightly shorter than the second or third, which latter two are equally long, the first being somewhat longer.

In the female the first and fourth thoracic segments are longer than the second and third, the fifth is faintly sub-segmented on the dorsal side, laterally terminating in a strong spine similar to *Ichthyophorba denticornis* Claus (Opus citatum, p. 199, Tab. xxxv, Fig. 1).

We now place the glass slide under a compound microscope, applying a low magnifying power and inspect the left, normally shaped, anterior antenna (see Fig. 1).

It is beset with pretty large bristles, and consists of twenty-five joints. When connected with the body, the fifteenth joint will reach to the base of the abdomen, and the terminal bristles reach to near the tip of the furcal bristles. The anterior antennæ originate from the first pair of larval legs, and are the means with which the Diaptomus performs its peculiar jerking motions, described by Herrick in American Naturalist, 1879, page 622.

In glancing at the right antenna of the male (see Fig. 2) one would think it had been taken from an entirely different species—so dissimilar it looks! If we count the joints, we find but twenty-three, two joints less than in the left antenna. But either the tenth or twelfth joint must consist of two connate joints, and the twenty-first is evidently also sub-segmented, making in all, twenty-five joints. The sixteenth to the nineteenth joints, inclusive, are considerably dilated and swollen, enclosing a powerful muscle, inserted near the fifteenth and in the twentieth joint; thence follows the knee-shaped section of the antenna, the geniculating part, consisting of a larger joint with an inner duplicature or

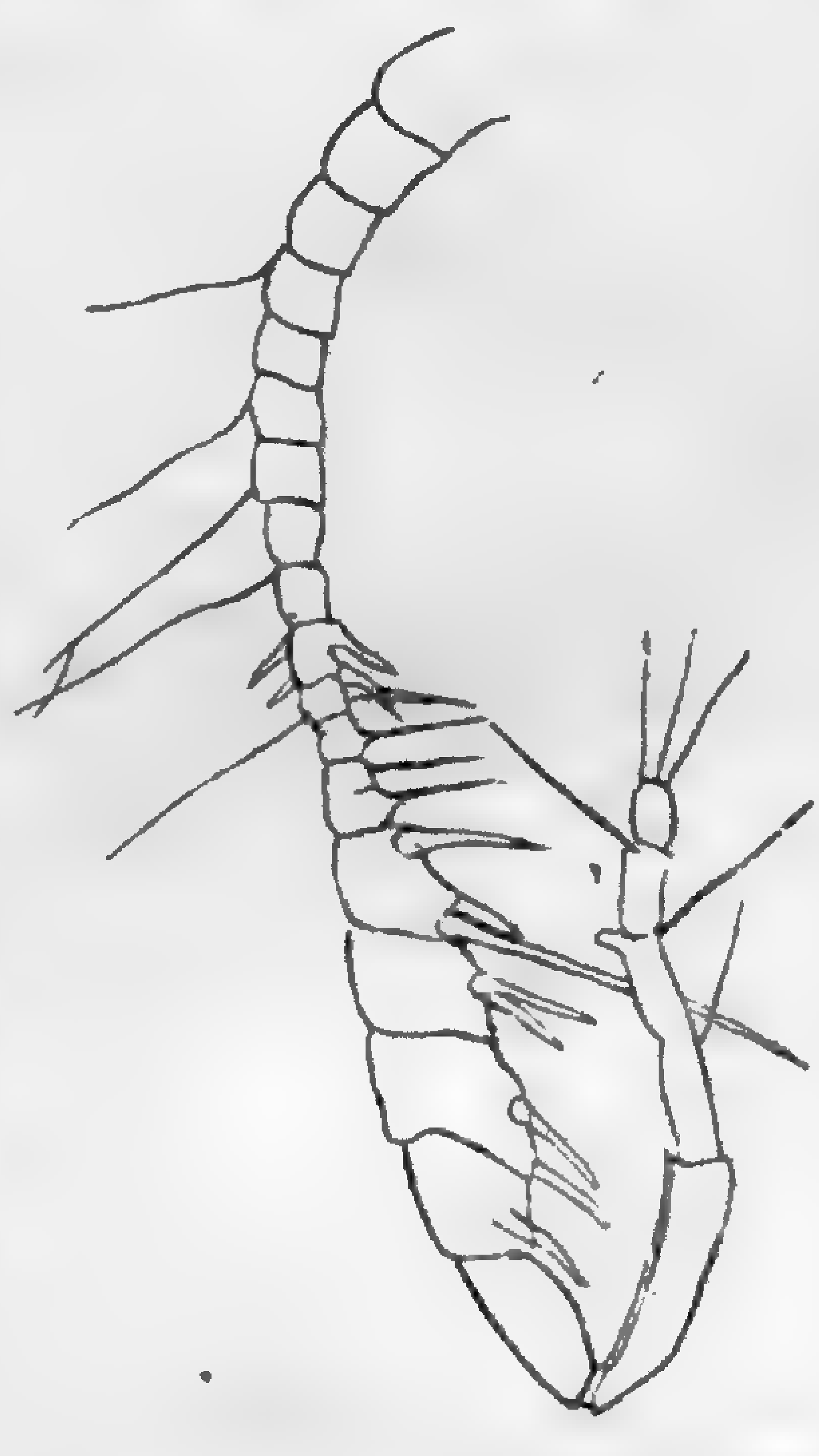

Fig. 2.—Right anterior antenna of male.

bead, forming a tier (originally several connate segments), and another larger, semi-segmented joint with a terminal, inner, bent-backward hook, and finally two smaller terminal joints. The dilated joints as well as some of the narrower preceding joints, are armed with powerful spines, and others with bristles. If this swollen right antenna be separated from a live male, it will twist around with snake-like motions for several minutes.

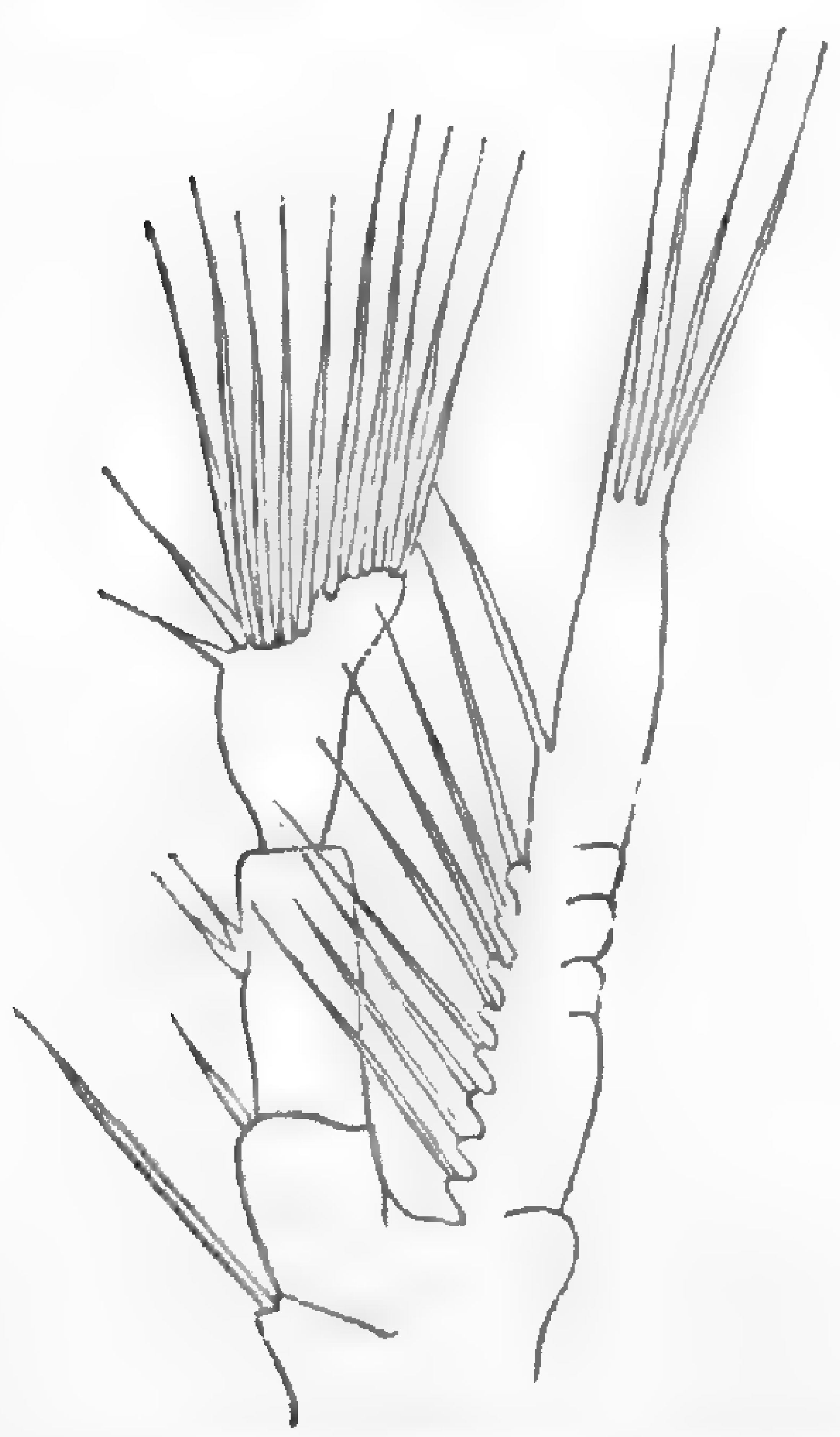

FIG. 3.—Posterior or second antenna. Main branch shorter.

As the external structures, with the exception of the fifth thoracic segment, the anterior antennæ, the fifth pair of legs and the abdomen, are alike in both sexes, we may proceed to the posterior or second pair of antennæ (see Fig. 3).

The posterior antennæ originate from the second pair of larval legs and have like those two branches. They are destined for locomotion, and also for respiration. The main branch is slightly shorter than the secondary branch.

Having once with certainty recognized the mandible (Fig. 4), then, after applying higher powers (about 500 ×), we are enabled to see the following characters: The tip of the first (outer) tooth is bent and has a very minute excavation. There are eight mandibular teeth. The second tooth is larger than any of the remaining six of the series, its suddenly contracted tip somewhat bent like the first tooth; it is separated from the third by an interval equal to the width of the tooth. A short stiff bristle appears at the lower end of the row of teeth. The secondary appendage of the mandibular palpus is four-jointed and bears six delicate bristles at its tip and inner margin. The larger, bent-upward bristle near the inner

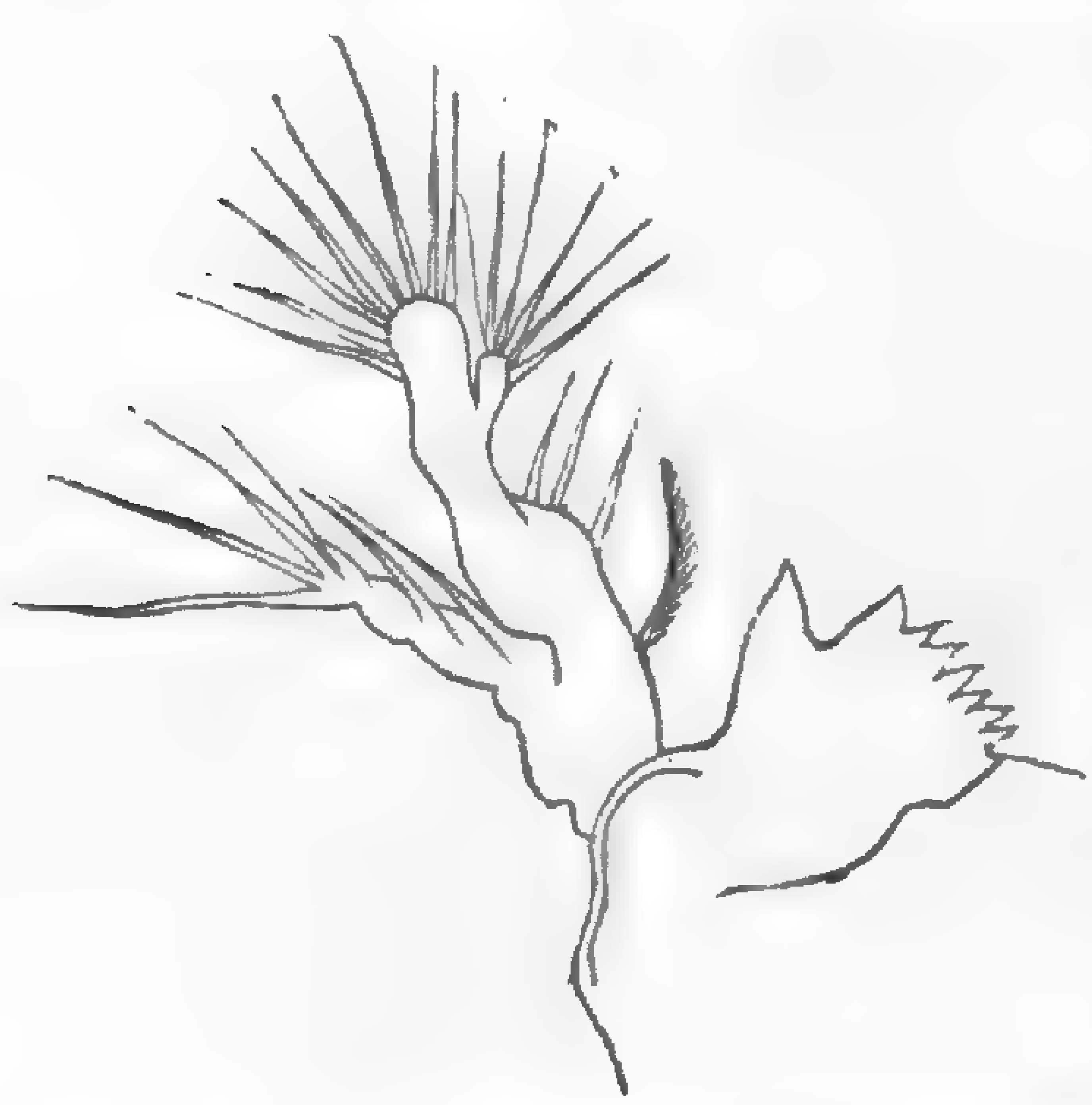

FIG. 4.—Mandible and mandibulary palpus. Enlarged about 300 ×.

base of the main mandibulary palpus is delicately bristled exteriorly only. Three smaller ciliæ are found above the latter on a small protuberance.

The mandible in all Copepoda originates from the third larval leg, which is already in the "Nauplius stage," provided with a dentate mandibular process. In the family of Calanidæ, the mandibulary palpus is comparatively longer than in the other five families of Copepoda.

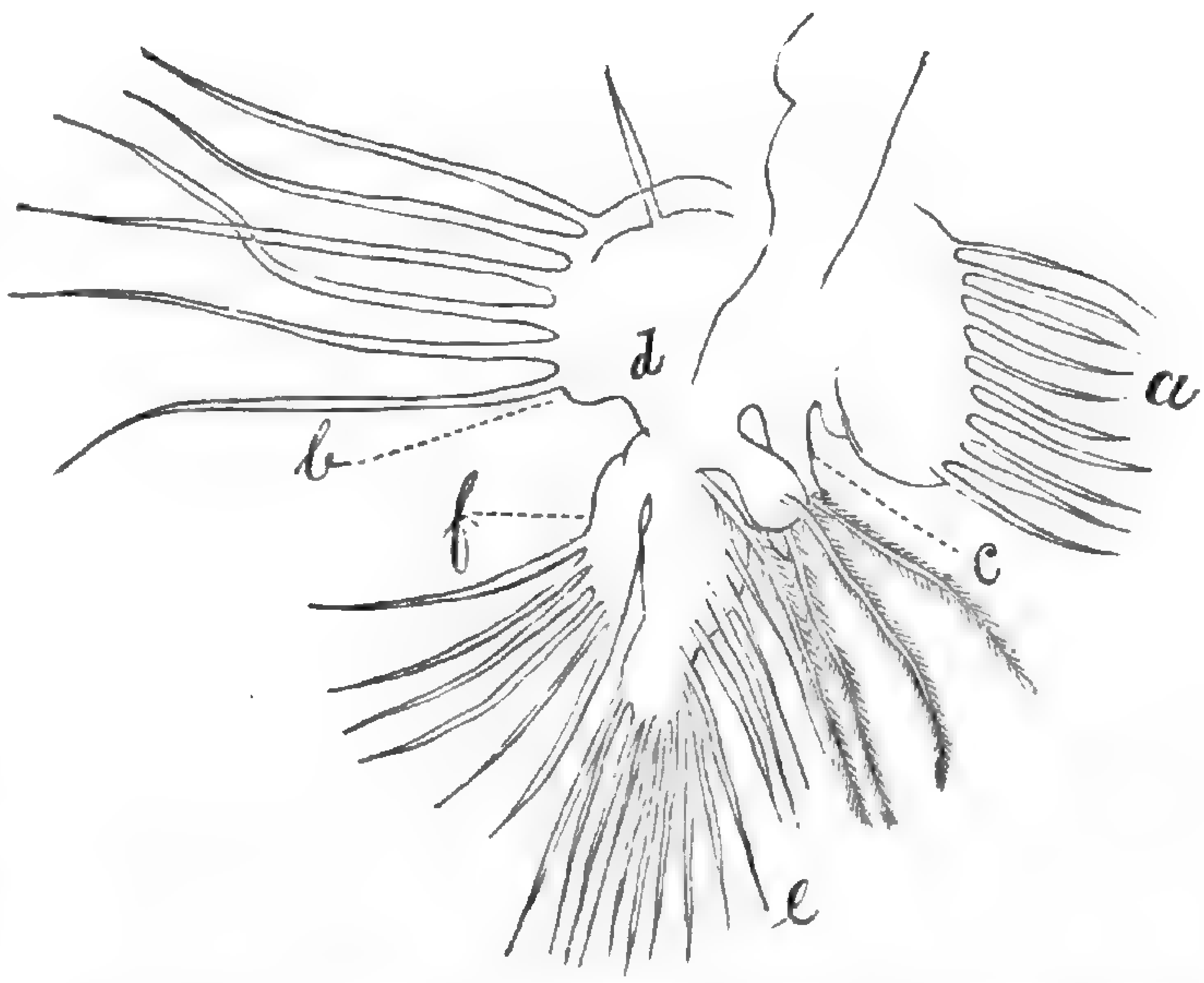

FIG. 5.—Maxilla. *a*, maxilla proper; *b*, basal broad lobe; *c* and *d*, two cylindrical basal processes; *e*, terminal palpus; *f*, posterior lobe, or secondary branch of palpus. Enlarged about 300 ×.

The maxilla (Fig. 5) is quite a complicated structure, consisting of several lobes, the explanation of which is found below the cut. The maxillæ are the second pair of oral organs, and originate from the bristled and lobed appendages of the larva, and these occur behind the third natatory leg, or future mandibulary palpus.

Another minute mouth-piece is the superior or first maxilliped (Fig. 6). It is somewhat sub-jointed, elongate, and bears fifteen bristles as the illustration shows. Both the superior and inferior maxillipeds are the separately diverging branches of a single pair of limbs originating out of the fifth pair of legs of the later "Nauplius stage," and are in the adult, with a few exceptions, dissimilarly inserted, the outer branches of those legs being transformed into the superior, the inner branches into the inferior maxillipeds.

FIG. 6.—Superior or first maxilliped. Enlarged about 400 ×.

We now take a look at Fig. 7, representing the inferior or second maxilliped. Its basal segment presents in our species four rounded processes on

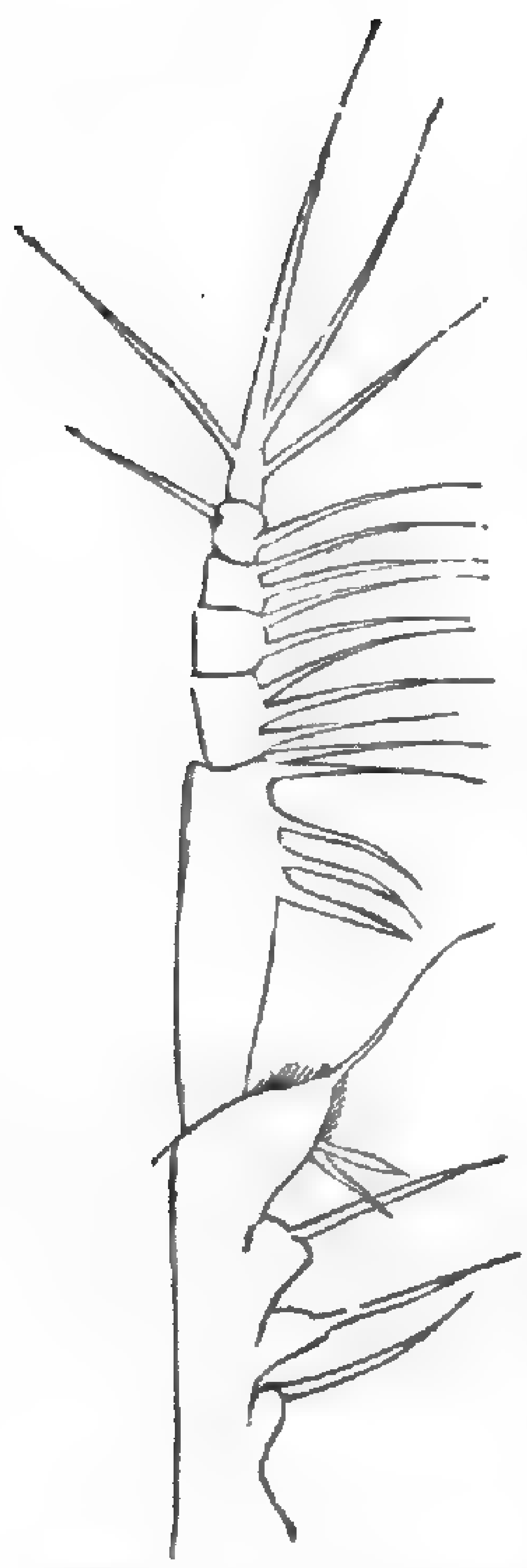

FIG. 7.—Inferior or second maxilliped.

its inner margin, the three first of which gradually become larger from base upwards, and bear each, one invaginate spine, the fourth is slightly produced inferiorly (the rounded tip being finely ciliate down to the produced lower middle), there (at the lower middle) bearing two spines directed downward, and a very fine long flagellum at its tip. The arrangement of the bristles of the last two joints, as well as the general outline of the whole, differ from *Diaptomus sanguineus* F.

The inner branch of the first of the four pairs of natatory legs has two, the rest three joints (see Fig. 8). Their purpose is aëration of the blood as well as locomotion.

The fifth pair of legs in the female is biramose, both branches arise from a two-jointed basal piece (coxa and trochanter), the inner branch is short, straight, slender, not jointed, abruptly terminating in a conical tip surrounded with microscopically small spines around a longer median one; at the side of the tip and opposing each other are two longer, movable (?) spines. The outer branch arises from the second broad basal joint, and is strong, two-jointed, terminating in a single, interiorly (near the tip) fine serrate claw, which has exteriorly two (one longer and one shorter) diverging spines a little above its middle (Fig. 9).

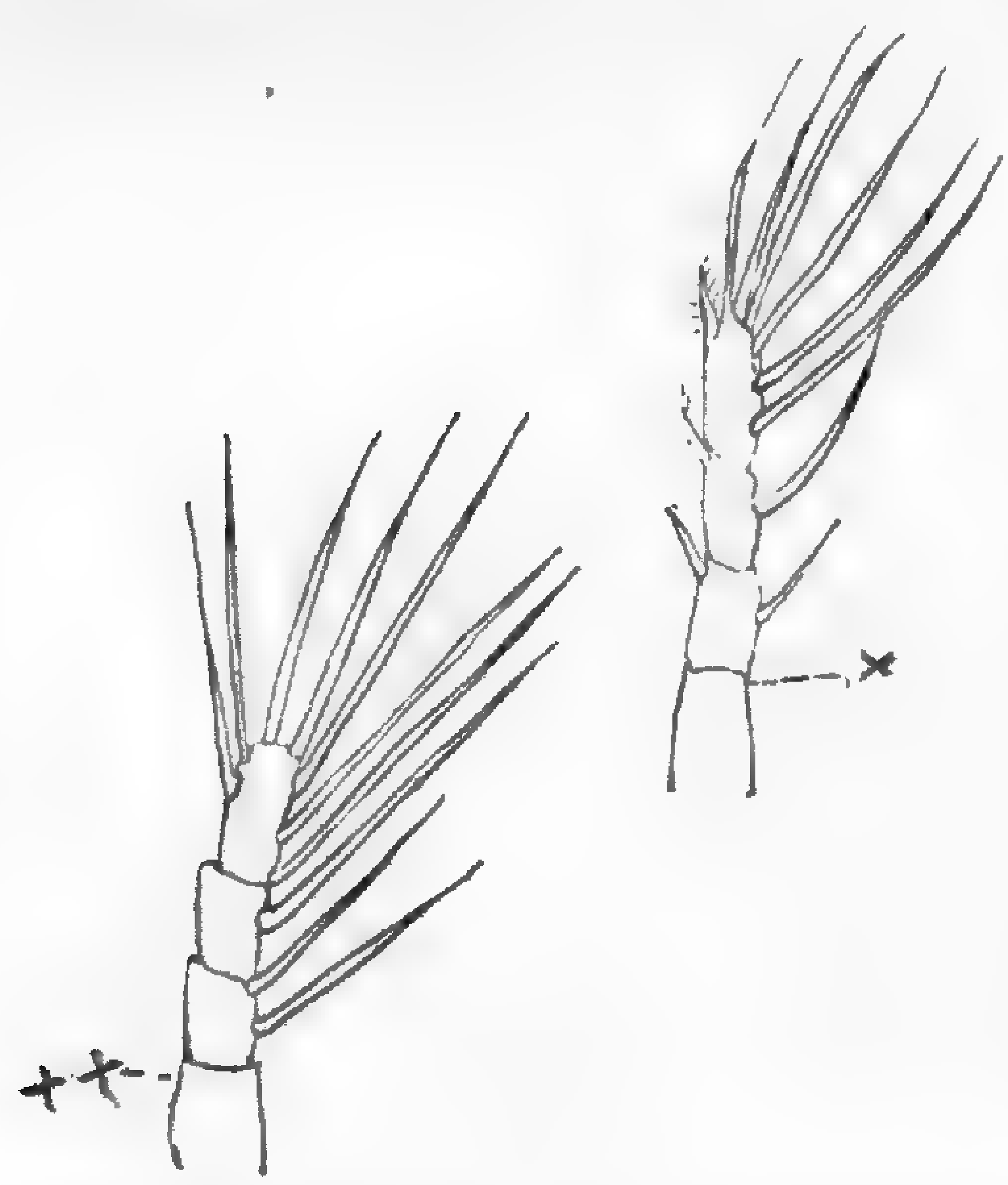

FIG. 8.—Form of second, third and fourth natatory legs. xx, inner branch; x, outer branch.

The office performed by the transformed fifth pair of legs in female individuals is not sufficiently known. They may be for the protection of the egg-sac or for properly placing the same, or perhaps they coöperate with the male in copulation. In some cases they may burst or pierce the spermatophores fastened below the female genital pore.

The fifth pair of legs in the male (Fig. 10) are very dissimilar. They both arise from a quadrate coxal joint; the left leg consists

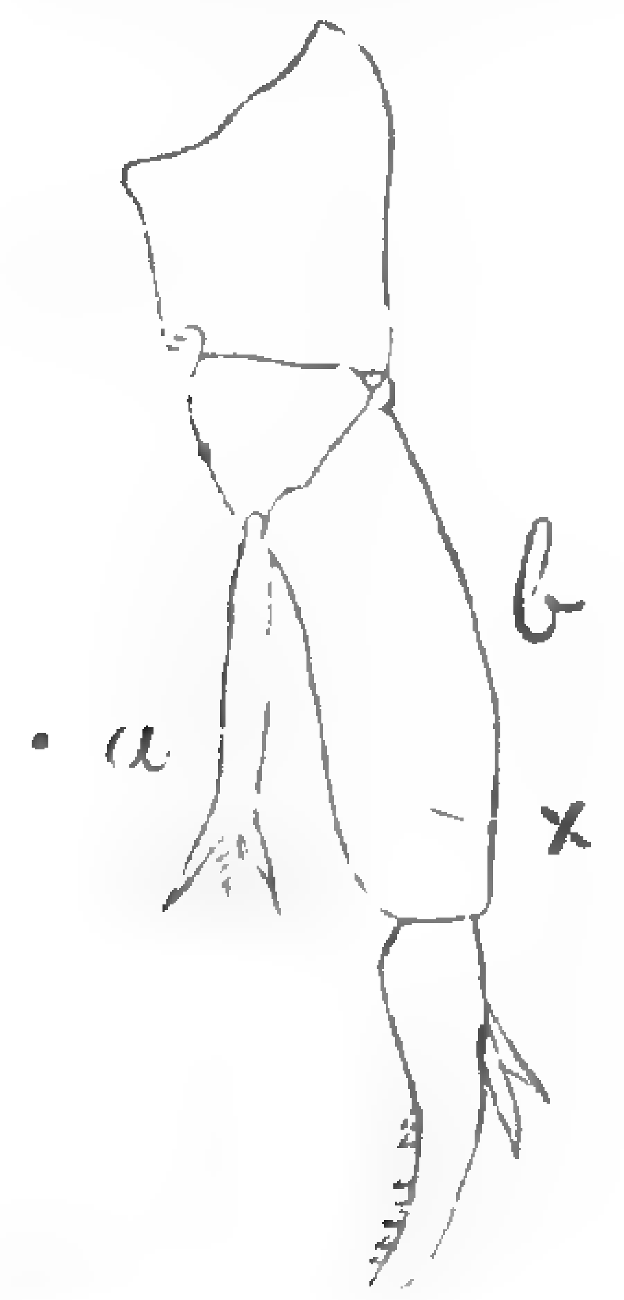

FIG. 9.—Fifth pair of legs of the female. *a*, inner, and *b*, outer branch.

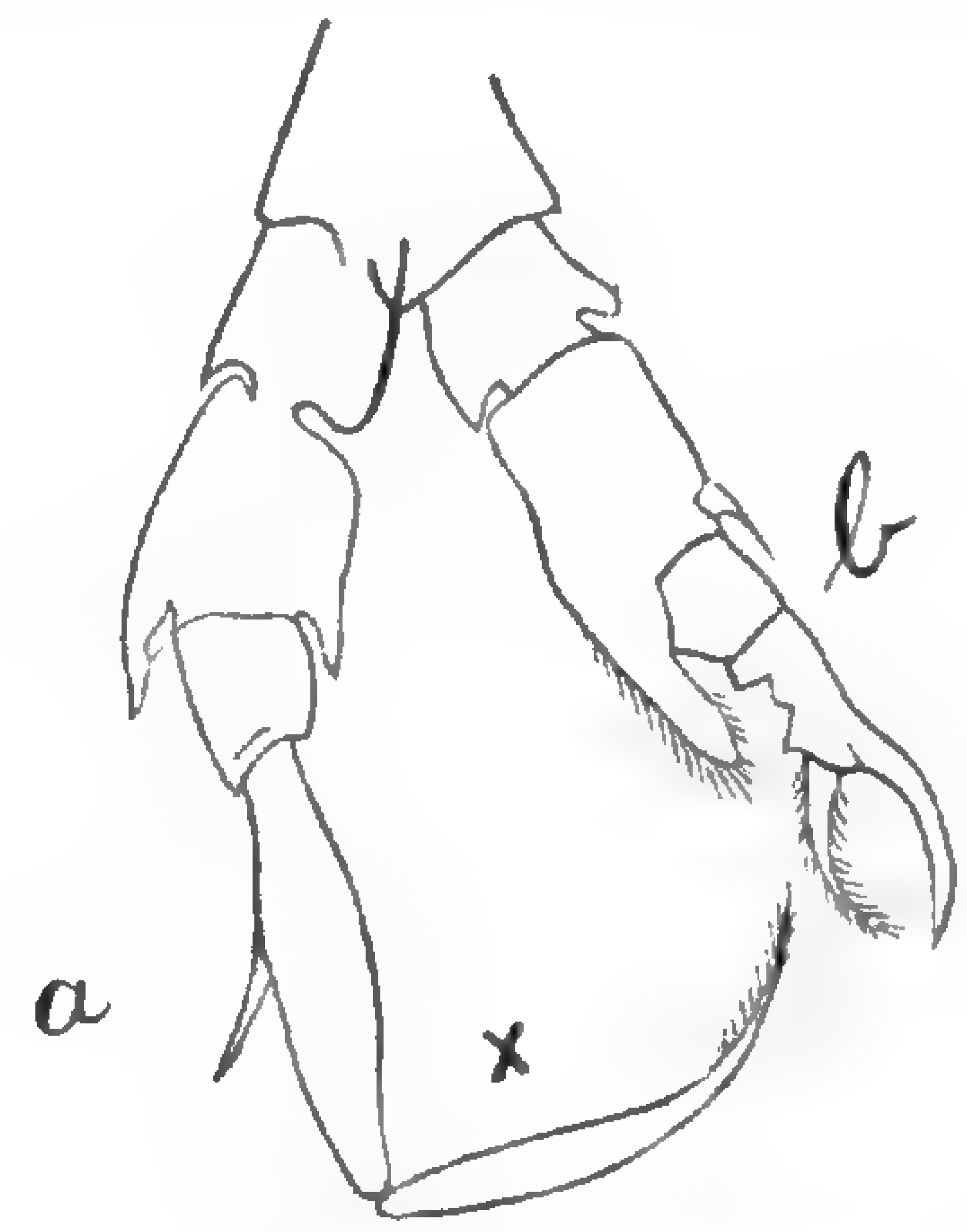

FIG. 10.—Fifth pair of legs of the male. *a*, right, and *b*, left leg.

of four joints, the first joint is quadrate and about one-third wider than long, slightly enlarging distally. The second joint is somewhat enlarged distally, about twice as large as the preceding joint, and bears a strong, wedge-shaped, blunt and finely serrate spine at the inner, and a shorter, slender one at the outer inferior angle. The third joint is clavate and distally tapering. The fourth joint is composed of an anteriorly notched, narrow basal piece exteriorly terminating with an incurved dactyl. The joint is from base to tip of dactyl, about two and a half times longer than the preceding joint; it terminates interiorly with another dactyl, nearly as long as the other; is finely serrate on both sides and acts in closing as a forceps. The right leg consists of five joints, the basal and the second joints are quadrate, the latter enlarges distally and bears a smaller blunt spine at the inner, and a larger one at the outer angle. The third joint is subquadrate, slightly tapering distally, the fourth joint is clavate, bearing a slender spine at the middle of its outer margin, and the fifth constitutes a slender incurved dactyl as long as the preceding joint, finely rugose on the distal half of its inner margin, and is so jointed as to close back against the inner margin of the fourth joint, which thus acts as a hand. The left leg (in Fig. 10, *b*, purposely drawn larger) reaches only about to the tip of the third joint of the right leg.

In the family of Calanidæ, in general, the abdominal segments are considerably narrower in the male than in the female, the former consisting of five, the latter of four segments. The first of the five male abdominal segments is as long as the fifth, and is the broadest, its anterior ventral angle is prominent, the second joint is twice as long as the preceding, the third and fourth gradually shorter. Furca, from base to tip of bristles, longer than the first, second and third segments together.

The first of the four female abdominal segments bears ventrally an opening on a circular elevation (in Fig. 11, seen from the side), the female genital orifice, to which the secretion of a gluey mass, the product of two large orbicular cement glands, situated on the segmentation line between the fifth and sixth thoracic segments, flows. Mounted specimens plainly show the two ducts of the glands running down to the orifice in the first abdominal segment. The two ovarial lobes begin with broad rounded bases in the second thoracic segment, and gradually taper downward. Although I was unable to find the oviduct entering the first abdominal segment, it is evident, from the position of the egg-sac that the products of the cement gland and ovary have one and the same exit. A *receptaculum seminis* is wanting.

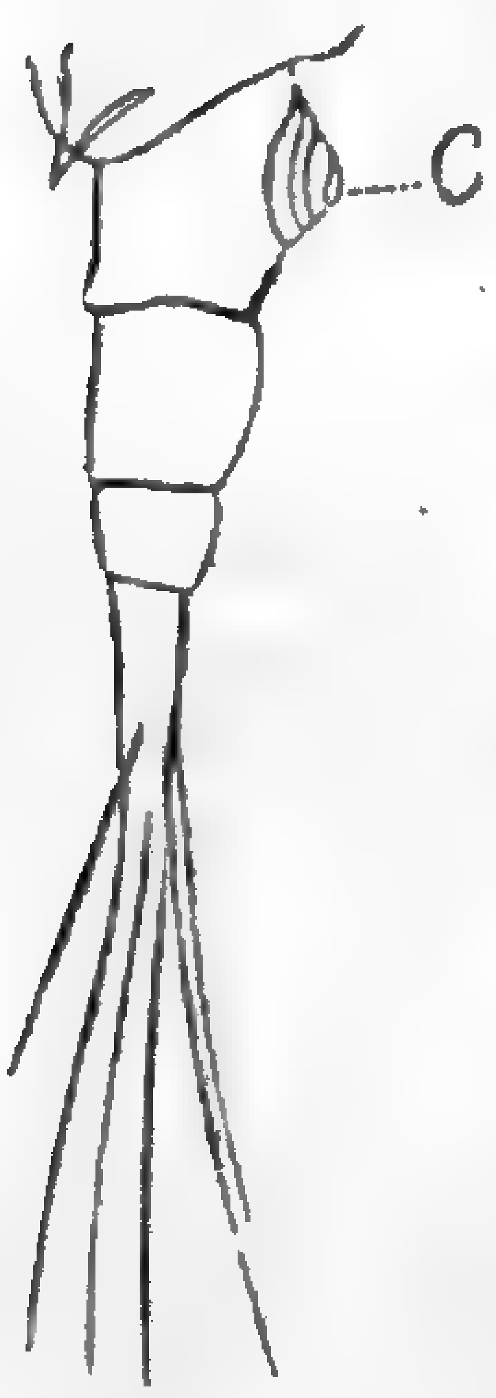

FIG. 11.—Side view of the four abdominal segments of the female. *c*, abdominal pore or genital orifice.

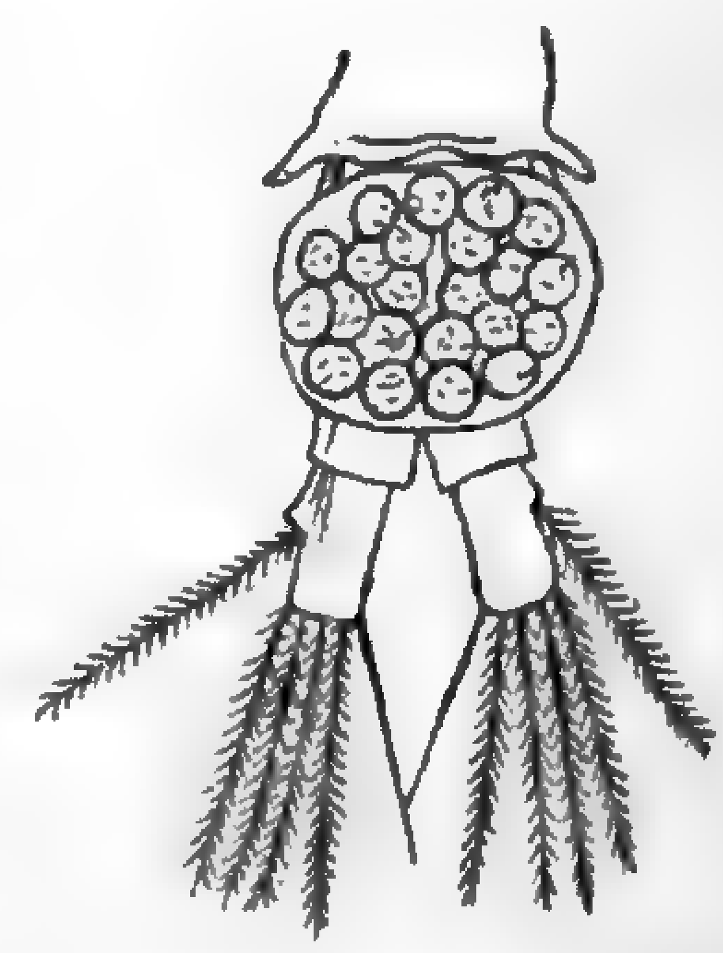

FIG. 13.—Front view of last thoracic segment below which, on the abdomen, is seen an egg-sac and the furca (the latter drawn larger in comparison with the rest).

The second segment is a little shorter than the first, the third is about half as long, the fourth is still shorter and bears the furca (Fig. 13), with orbicular egg-sac. From thirty to forty eggs are contained in a sac.

The spermatophores containing the fertilizing zoösperms are glued by the fifth pair of legs of the male to the female genital orifice during copulation. I noticed from one to four spermatophores on some females (Fig. 12).

The inaugural dissertation of Dr. Aug. Gruber, "Ueber zwei Süsswasser-Calaniden," Leipzig, 1878, pp. 34, two plates, gives us the latest knowledge concerning the formation and action of the spermatophores, and as this special work may not be in the hands of every American carcinologist, and owing to the complexity of the matter itself, an abstract of the same, I trust, will be welcome.

In the male the *vas deferens* can be distinguished into three distinct sections, each of them performing a different function. The glandular cells of the walls of the first section secrete a viscid, gluey substance, a sort of cement into which, coming from the testis and passing through the posterior terminus of the *vas deferens*, the elongate (in Diaptomus) zoösperms enter, forming a long narrow string. The diameter of the first section is nearly of equal width in its entire length. The second section is more dilated anteriorly, rounded and tapering posteriorly. Here we find a central, voluminously swelled mass, the above mentioned homogeneous glue-mass, peripherically surrounded with a layer of densely packed zoösperms, which but loosely fit into innumerable roundish lodges or hives, the latter constituting the interior of the partly perfected exterior spermatophore capsule. The formation of the latter began probably already in the first section, since the two sections do not functionally differ from each other. This still imperfect spermatophore enters immediately into the third and last section of the *vas deferens* as soon as the last perfect one has just left the male genital orifice.

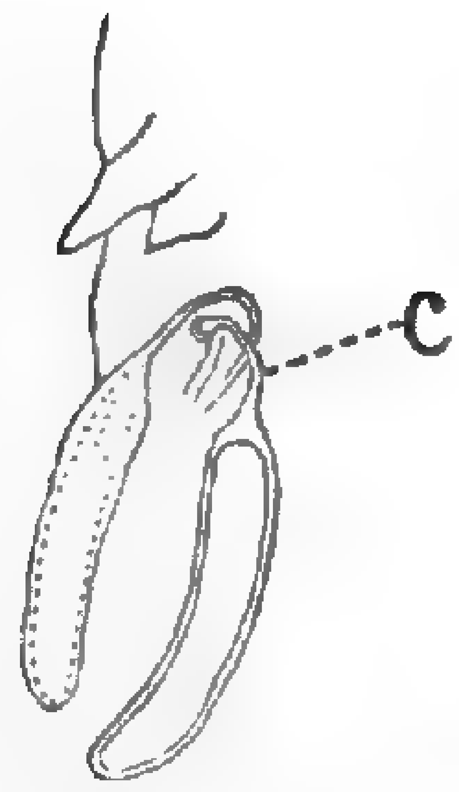

FIG. 12.—Front view of right angle of the last thoracic segment of female and part of the first abdominal segment with two spermatophores, *c*, one is partly and the other entirely empty.

FIG. 14.—A male *Diaptomus sanguineus* var., enlarged about 8 times. Side view.

A number of zoösperms in the posterior rounded terminus of the spermatophore act as abortive or expelling factors, becoming first granulated toward the perfection of the spermatophore, and, through the endosmotic absorption of water, several of them coalesce with a number of cellular vesicles like soap-bubbles (polygonal in Diaptomus). The expelling cells gradually swell, pressing the central glue-mass into the middle of the spermatophore, and first become nucleate and then plain. Through the further increase of these expelling cells, the central glue-mass is more and more compressed and slowly moves toward and out of the narrow terminus of the spermatophore, and in oozing out forms a saussage-like body, by means of which, in copulation, the spermatophore is glued beneath the valvule of the female genital orifice. Into the center of this mass follows the remainder of the zoösperms, the latter being perfectly surrounded by the former, forming a minute ball. The glue-mass, according to Dr. Gruber, evidently yields also the material for the formation of the egg-sac, since, firstly, in oozing out of the valvule the eggs are driven into the mass, and secondly, the egg-sac is not formed before the act of sexual union.

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SCOLOPENDRELLA AND ITS POSITION IN NATURE.

BY A. S. PACKARD, JR.

THE recent notices by Mr. John A. Ryder, particularly his last able paper,[1] have called fresh attention to this interesting creature, and his discovery of two species in addition to the one originally noticed by the writer, shows that the United States are as much favored as Europe in specific forms. Scolopendrella is a small, whitish tracheate animal, not exceeding a quarter of an inch in length, with a superficial resemblance to a myriopod, such as Scolopendra, having a pair of well developed, five-jointed legs to each abdominal as well as thoracic segment; its name ending in a diminutive gives evidence of the original opinion of its discoverer, that it was a small myriopod, like Scolopendra, the centipede. In deference to the general opinion of naturalists in our "Guide to the Study of Insects," and our "Zoölogy" we have let it remain among the Myriopods, but it occupied an uncertain place, as we waited for more light upon the subject of its affinities, and for time to study it with more care.

Attention was first called to the existence of this type of Tracheates in the New World by a brief notice which appeared in the Proceedings of the Boston Society of Natural History, Vol. XVI, p. 111, 1873, which read as follows:

"For nearly two years we have had in the Museum of the Peabody Academy of Science a specimen of Scolopendrella, detected September 8, by Mr. C. A. Walker, under a board in the grounds of the museum. It is nearly related to *Scolopendrella immaculata* Newport, and if new may be called *S. americana.* Of the remarkable features in the structure of this animal I do not now propose to speak. It has, however, in the head and antennæ a strong re-

[1] The structure, affinities and species of Scolopendrella, Proc. Acad. Nat. Sc. Phil., 1881, p. 79.

semblance to Campodea, and in this and in the presence of spines at the base of the legs, and in other characters, it bears a striking similarity to the Campodeæ and the Thysanura, as already indicated by Lubbock. It may be regarded as a connecting link between the Thysanura and Myriapoda, and shows the intimate relation of the Myriapods and the Hexapods, perhaps not sufficiently appreciated by many zoölogists."

It will thus be seen that eight years ago we called attention to the strongly marked Thysanurous features of Scolopendrella, a fact apparently overlooked by Mr. Ryder, who quotes at length, however, the opinion of Menge in 1851, who, therefore, was the first to call attention at some length in an able paper, to the structure of Scolopendrella, of which Mr. Ryder gives a useful abstract.

Up to last year Scolopendrella had been left undisturbed in its niche among the Myriopoda, when in 1880, in this journal,[1] Mr. Ryder boldly suggested that it should be regarded as the type of a distinct order of articulates, and called attention anew to its close relationship to the Thysanura; and in his last paper gives the characters of the order, and a list of the known species, with descriptions of a new one, under the name *Scolopendrella gratiæ*. He also figures a form very closely allied to, if not identical with *S. notacantha* of Europe.

Having collected considerable material, notes and drawings for a monographic account of our Thysanura, and having worked out the external structure of Campodea and Lepisma, we have long been anxious to study with care the structure of Scolopendrella. A species occurred at Salem, Massachusetts, which we called provisionally *S. americana*, deferring a description of it until we could get from Europe specimens of Newport's *S. immaculata.* Writing for several years past without success to naturalists in England, Belgium and Denmark, during the past spring we had the good fortune to receive several specimens of this species from Bohemia, through the kindness of Dr. Latzel, author of a work on Austrio-Bohemian myriopods, which we have not, however, seen.

I afterwards, in 1874, found two specimens of my Salem form under stones at the mouth of a small cave (White's cave, Jr.) near Mammoth cave, and the same spring Mr. Sanborn collected one in a cave near Dismal creek, near Mammoth cave.

[1] Scolopendrella as the type of a new order of Articulates (Symphyla), AMERICAN NATURALIST, May, 1880.

On comparing them with seven well preserved specimens from Bohemia, I find no difference, except that our form has rather longer and slenderer antennæ than any of the Bohemian specimens; the American cave individuals have uniformly thirty-three joints, and the spaces between the nodes are longer than in the Bohemian ones, which have from twenty-one to thirty-two joints. We do not, however, regard this as a specific character in so variable a genus as this, and it may be that out-of-door forms may occur in this country with shorter and stouter antennæ, like the European one. We regard, then, our *S. americana* (no description published) as a synonym of *S. immaculata* Newport.

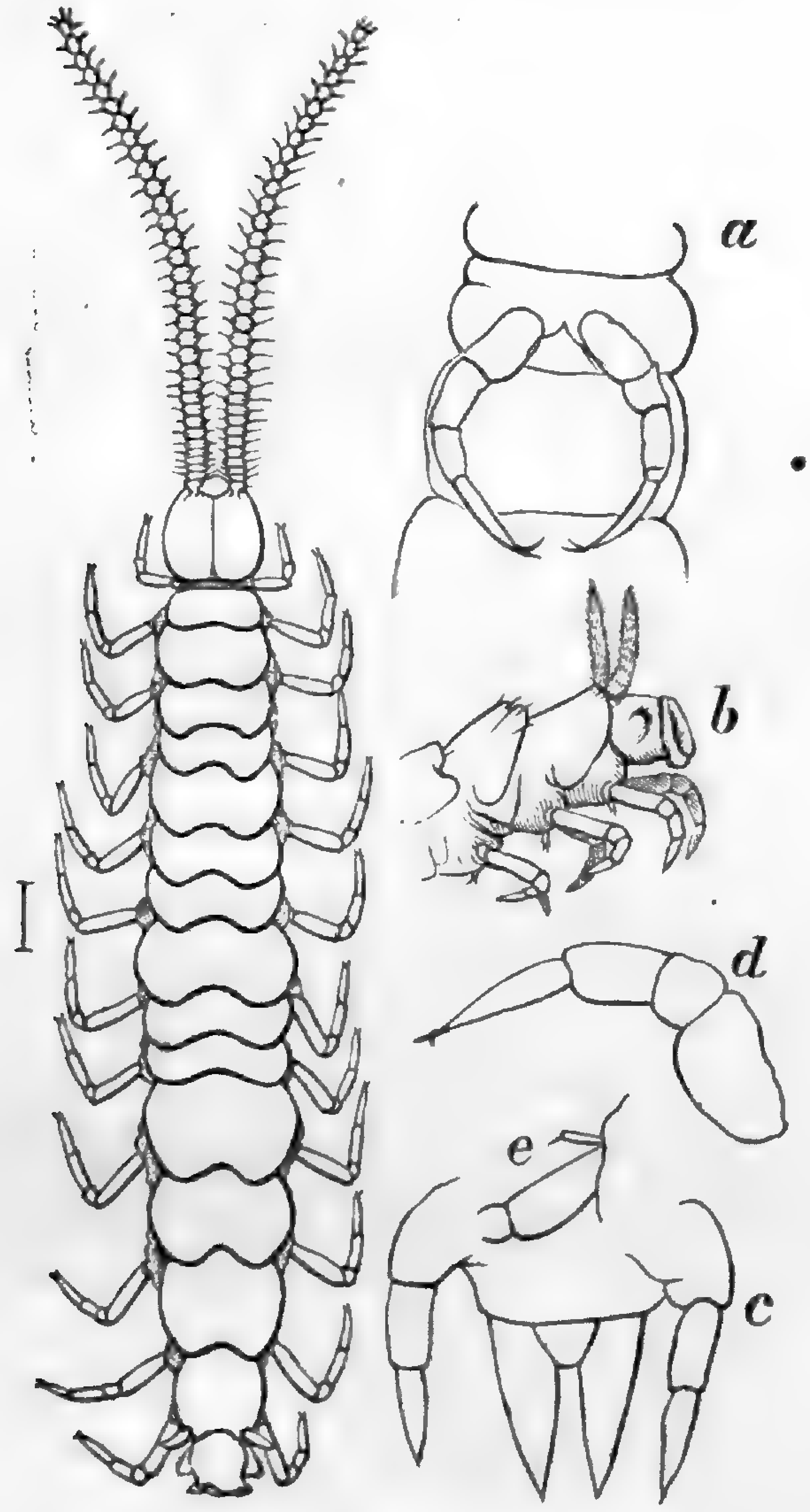

FIG. 1.—*Scolopendrella immaculata* highly magnified; *a*, second thoracic segment with legs; *b*, end of body, showing the caudal stylets; *d*, a leg, first joint not shown; *c*, end of the body, showing caudal stylets; *e*, base of leg with supplementary appendage. Emerton and Packard, del.

The adjoining figure, drawn by Mr. Emerton from the specimens from White's cave, Jr., with the details of the caudal appendages drawn with the camera from the Salem specimen, will represent this form, which is 5 mm. in length.

Let us now look at theThysanurous features of the Scolopendrella, and then compare it with the Myriopods, such as our common Lithobius.

The structure of the head is exactly as in Campodea, the form of the epicranium being the same, having a well marked median suture, while the posterior edge of the clypeus is angular, the apex of the triangular edge meeting the epicranial suture, as in Campodea; the labrum is small and rounded in front (what Menge calls the labrum is in reality the clypeus). The mode of insertion of the antennæ and their shape is as in Campodea. The form of the clypeus and of the antennæ are entirely unlike those of any Myriopod known to us. The mouth-parts bear the same relation to the head, and are sunken or withdrawn into the head in the same peculiar manner, as according to Meinert and our own repeated observations, characterizes the Thysanura. The bases of the jaws and maxillæ are contained deep in the cavity of the head or epicranium, only the ends projecting out, as in Campodea.[1] The mandibles are slightly curved, toothed, and constructed on the Campodea type; the maxillæ are long and slender, and in a side view are seen through the walls of the thin epicranium, appearing much as in Campodea. Their structure is in general like that of Campodea.

The legs are five-jointed and, as observed by Menge and Ryder, end in two claws, as in Campodea; in Myriopods there are six joints, and always a single large claw. The stigmata we have found to open between and just behind the legs, as Mr. Ryder has stated, but we have been unable to find any in the first and second segments behind the head; those corresponding to the prothoracic and mesothoracic segments of hexapodous insects.

The v-shaped opening, supposed to be either sexual or to correspond to the sucking organ of Thysanura, we have observed only in the fourth segment, or that corresponding to the first abdominal segment of Thysanura and insects in general. We are disposed to regard this as the homologue of the sucker of

[1] Meinert (Annals and Mag. Nat. Hist. 1867, p. 362), ascribes great importance to the "position of the first two pairs of appendages of the mouth with reference to the skull." In most insects, and in the Myriopods, the jaws for example act transversely and articulate with the epicranium by means of a hinge-joint. In the Thysanura the bases of the mandibles and maxillæ are retracted within the cavity of the epicranium, and are buried in muscles, while generally only their points project outside of their mouth. This is the case with Thysanura, both in Campodea and allies (our suborder Cinura), and in the Poduræ, or Collembola, but in the highest Thysanura, Lepisma, the jaws are external and articulated to the skull outside of the mouth, and thus Lepisma approaches the true hexapod insects, and affords a passage from one type of head to the other. Scolopendrella, with its feeble jaws and maxillæ buried in the mouth and enveloped in muscles, is throughout Campodea-like, and essentially unlike the Myriopods, such as Lithobius and Scolopendra with their large, powerful, biting jaws, hinged to the thick, solid epicranium and acting transversely.

Poduræ, and which we have designated as the collophore; the occurrence of this opening on the fourth ring indicates that in Scolopendrella we may distinguish between a series of three thoracic segments and about nine or ten abdominal segments.

Now examining the supposed myriopodous features of Scolopendrella, we find that they consist in the identity in form of all the body segments behind the head, and in the fact that each segment bears a pair of functional several-jointed legs. In Machilis, however, the thoracic segments grade almost imperceptibly into the abdominal arthromeres or somites; though in Lepisma, and especially in Japyx and Campodea the thoracic segments are clearly differentiated from the abdomen.

Now the possession of functional jointed abdominal legs by Scolopendrella does not imply that it is necessarily a Myriopod; we have seen that the feet differ in important respects from those of the centipede, and the presence or absence of abdominal feet is not an ordinal or very important character, for the head characters are both in Hexapods as well as in Arachnida and Myriopods, of the most importance in separating orders and subclasses. Turning now to the Thysanura, we see that Campodea has a series of one-jointed abdominal appendages which are, as we have observed, very movable while the insect is running. They appear to be rudimentary locomotive appendages. Those of Machilis are much better developed and are still more leg-like; the two pairs of terminal shorter stylets of Lepisma we have observed are used as prop-legs, so that the transition from the legs of Machilis to Scolopendrella is not a very abrupt one. We therefore conclude that the sum of the characters of Scolopendrella are Thysanurous, and that the homogeneity of the body segments and the five-jointed legs which has led to their being regarded as Myriopods, have misled naturalists; Scolopendrella seems to us to be only analogous to the Myriopods as regards its feet. The presence of the two caudal stylets is also a Thysanurous feature; these organs we should regard as homologous with the stylets of Lepisma and the forceps of Japyx. Menge and Ryder regard them as spinning organs, and we would agree with this opinion, as in one of the specimens from Bohemia, we could see the ducts leading into each stylet, from one of which a silken thread projected. From Menge's statement that the opening of the oviduct lies immediately above the anus, we should dissent on general grounds, as in no known arthropod is this the case. Although we have not been able to find the opening, it should be looked for between the second and third segments from the anus.

The view of Menge and of Ryder that "these singular animals should be separated from the myriopods proper," will, it seems to us, be concurred in by any one who may carefully examine into the matter.

Now arises the question as to the real position of the Scolopendrella. Mr. Ryder gives the following results of his able investigations:

"This form as interpreted above, becomes of the highest interest to the zoölogist, and if the writer is not mistaken, the biunguiculate legs and their nearly complete correspondence in number with the rudimentary abdominal and functional thoracic limbs of the Thysanura, especially Machilis and Lepisma, which also have basal appendages to the legs, indicate as much affinity with insects as with myriopods, and may indeed be looked upon, perhaps, as representing the last survival of the form from which insects may be supposed to have descended. I name the new group *Symphyla*, in reference to the singular combination of myriopodous, insectean and Thysanurous characters which it presents." He regards the Symphyla as an order with one family, the *Scolopendrellidæ* of Newport. We had been ready to adopt this order, though we felt uncertain as to its position; but on a re-examination of the structure of *S. immaculata*, and from the information afforded by Menge and Ryder, have been led to question whether the Symphyla should be regarded as an independent order of Tracheata, and if so, whether they should be included with the Thysanura among the genuine insects or not. We see no reason why the Thysanura should not be regarded as an order standing at the bottom of the hexapodous series, and constituting an eighth order of Hexapoda. We regard the *Collembola* of Lubbock as a suborder of Thysanura; we have in the seventh edition of our "Guide to the study of Insects," 1880, thrown the Lepismatidæ, Campodeæ and Japygidæ into a new suborder called *Cinura*. Now the question arises, have the *Symphyla* characters sufficiently distinctive to keep them apart as a separate order, next to and below the Thysanura as a whole, or should they be regarded as a third suborder of Thysanura equivalent to the *Collembola* on the one hand, and to the *Cinura* on the other? We are inclined to the latter view.

The distinctive Thysanurous character of the Symphyla, are the form of the head as a whole, that of the epicranium, and of the clypeus and the small labrum, as well as the mode of insertion of the antennæ, and their form. The mouth parts, *i. e.*, the mandibles, maxillæ and labium, have the essential form of Campodea; the caudal stylets are insectean. These characters do not remove them more than by one family from the Campodeæ and Japygidæ. They also have what is possibly a collophore; the spiracles are much as in Japyx, but situated between the legs, though the presence or absence of spiracles is so variable in the Thysanura as to be unimportant. The differential characters are the presence of five-jointed functional legs, and the dorsal scutes of the somites, the latter homonomous; but even here the claws are exactly as in Campodea, and we see an approach to the multiarticulate legs in Machilis, and the two pairs of long proplegs in Lepisma. Under these circumstances we should include the Symphyla as a suborder of Thysanura. At the same time we wish to bear testimony to the ability and good judgment shown by Mr. Ryder in dealing with a most difficult problem, and offer our own views for the consideration of zoölogists. None the less as pointed out by Mr. Ryder, is the view (we have also long held) well founded, that Scolopendrella is an ancestral, synthetic form. In this respect it stands side by side with the Campodea. The structure of this synthetic type also shows how close is the relationship between the hexapodous insects and the Myriopods, which are more closely related in most respects than the Hexapoda and Arachnida. We are also confirmed in the view that the Hexapods, Arachnids and Myriopods are too closely related to be regarded as independent classes, and should be regarded as subdivisions (subclasses) of Tracheata.

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AMERICAN WORK IN THE DEPARTMENT OF RECENT MOLLUSCA DURING THE YEAR 1880.

BY WILLIAM H. DALL.

SINCE the recorder prepared his last report on this subject (for 1879), Dr. James Lewis, of Mohawk, N. Y., well known for his researches into the natural history of land and fresh water shells of North America, has passed over to the majority. Fortunately the ranks of the working malacologists of America have not sustained any other loss during the past year, though the death of Professor Haldeman recalls the excellent work done in that department by him, many years ago.

The recorder would particularly request from authors, early copies of any papers bearing on malacological topics,[1] in order that this record may, in future, be more promptly prepared. This is especially desirable when the article is published in any of the semi-scientific periodicals of small circulation and uncertain tenure of existence, which appear from time to time, fulfill a certain good purpose, but usually demonstrate their unfitness for serving as a medium of communication with the scientific world, by a pervasive eruption of advertisements in the text, a feverish craving for clippings and a rapid descent into an early grave.

The year has been marked by no extraordinary discoveries in the biology of mollusks, but a fair amount of creditable work has been done, of which, perhaps, a larger portion than usual is of a high character. Several investigations of great interest are in progress, but it has seemed best to confine the record to such as has been irrevocably placed before the scientific world by publication.

General Works.—Mr. Tryon's Manual of Conchology has progressed, during the year, to the first part of the third volume. Volume second contains the Muricinæ and Purpurinæ, comprising two hundred and ninety pages and four hundred and forty-two figures on seventy plates. Volume three, of which part one appeared in the last days of the year, is to contain the Tritonidæ, Fusidæ and Buccinidæ.

Anatomy, Physiology and Development.—The most valuable work in this department, in 1880 as in 1879, is due to the labors of Professor W. K. Brooks. "Studies from the Biological Laboratory of the Johns Hopkins University" (Vol. I, Part IV), contains a memoir on "The development of the American oyster, *Ostrea virginiana* List." (pp. 1–104, pl. I–X), which also appears in the Report of the Commissioners of Fisheries of Maryland for 1880; and an article on "The acquisition and loss of a Food Yolk in Molluscan eggs" (pp. 105–116, pl. XI). The researches on the oyster having been undertaken at the instigation of the Maryland Fish Commissioners, the first thirty-four pages of this memoir contain in untechnical, but quite sufficiently exact phrase-

[1] Which may be sent care of the Smithsonian Institution.

ology, a statement of the nature, method and extent of the observations and conclusions reached from them, with a few words of warning in relation to the inevitable ruin of the beds to follow excessive dredging; the laws relating to which, it may be noted—though Professor Brooks does not mention it—are practically ignored. He finds the average number of eggs in an oyster of ordinary size to be about nine million, against less than two million reported for the European oyster; while some American oysters may furnish sixty million. In the European, however, the young are believed to be protected, during their most precarious stages, in the parent shell, so that perhaps $\frac{1}{43000}$ of them come to maturity, while our American species undergo their development in the open sea, subject to fatal changes of temperature and unnumbered enemies, which must greatly diminish the proportion of survivors. The sex of individuals during the breeding season, contrary to the oystermen's opinion, cannot be distinguished without dissection, and they appear, for the time being at least, to be singly male or female only, and never hermaphrodite.

The second part of the paper discusses some of the more abstruse topics connected with the subject, and is written more for the embryologist, as the former part is for the general reader. Among the conclusions arrived at, are the singleness of sex in the individual; that the impregnation is external to the shell; that the segmentation is remarkable for its rapidity; its bilateral symmetry and marked alternation of periods of rest and periods of repose; both regular and rarely-recurring irregular processes of segmentation are described, and the conclusion is reached that the process of Lamellibranchiate segmentation is a survival from ancestral conditions which included few large eggs provided with food-yolks, these last having been lost as the eggs became smaller and more numerous, while the mode of segmentation has been retained perfectly by the oyster and incompletely by other Lamellibranchs. The evidence appears to the author to strengthen his previously expressed opinion that the Lamellibranchs must be regarded as a side branch from a main stem, of which the Gasteropods are a much more direct continuation, and that the phylogeny of the higher Mollusca cannot be traced through the Lamellibranchs to lower invertebrate forms. Of these views, the second paper on the acquisition and loss of a food-yolk (with a comparative plate of embryo forms) is chiefly an amplification. The first memoir concludes with a discussion on the formation of the digestive tract, the shell and the mantle, and the relation of the facts observed to the Gastræa theory.

Apropos of the American oyster, a letter dated Gibraltar, June 14, 1880, from Mr. Francis Winslow, U.S.N., to Professor W. K. Brooks, appears in the January NATURALIST of the present year (p. 57), giving an account of an attempt made to fertilize some Cadiz oysters, and the unexpected agreement, so far as the observer was able to determine, of the development with that of the American form. Mr. Winslow says: "So far as these results go, they prove that the artificial propagation of the European oyster is practicable to just the same extent as our own, and I think it throws grave doubts on the theory that the embryo is protected within the shell, and that the impregnation occurs there and nowhere else."

The reporter in examining the exhibition of oysters at the Paris Exposition in 1878, saw shells of a species of oyster in the collections which was referred to as the "Portuguese" oyster, and which he could not distinguish from the shells of *O. virginiana.* These Portuguese oysters are regarded with contempt by the French oyster-cultivators, who advertise, as a merit, that their particular parks are free from contamination by this objectionable variety. They are said to be free from the coppery flavor of *O. edulis*, and to be larger and tougher—just the qualities ascribed to American oysters by those who are accustomed to the *O. edulis.* The observations on the embryology of the European oyster were all made on the *O. edulis.* If, therefore, these Cadiz native oysters were (as may be suspected) the "Portuguese" oysters of the French, and identical (as seems not impossible) with *O. virginiana*, the discrepancy would be explained without throwing discredit on the researches of those European naturalists who have examined the other species. Mr. Winslow, under the direction of the U. S. Coast Survey, made some very meritorious surveys of a part of the Chesapeake oyster beds in 1879. His report was published in the Report of the Maryland Fish Commission for 1880, by permission of the Superintendent of the Coast Survey; and its value, as we are informed, has since been recognized by the French Société d'Acclimatation, which has awarded a bronze medal to the author.

In the September NATURALIST (p. 674), Mr. J. A. Ryder describes the course of the intestine in *Ostrea virginiana*, which he found to have but one complete turn upon itself, and in the course of its (dorsal) flexure, to pass almost directly over the mouth, and to be provided with a pair of internal longitudinal folds.

Brooks in the *American Journal of Science* (Oct., 1880, p. 288) has a short article on the homology of the Cephalopod siphon and arms, in which he concludes that they are neither homologous with the velum nor the foot, but are independent developments.

In the Anniversary Memoirs of the Boston Society of Natural History (1880), Brooks contributes a paper on the "Development of the Squid (*Loligo pealii* Lesueur)," containing twenty-two pages and three plates. In this article he observes that while the squid embryo fails to give us any information as to how a typical mollusk has been modified to convert it into a Cephalopod, or the transformations undergone during the process, it nevertheless clearly shows the fundamental similarity of type which subsists between it and other Mollusca.

In last year's record allusion was made to Professor Verrill's "Cephalopods of the north-eastern coast of North America," Part I of which, including the gigantic squids and their allies, has since appeared in the Transactions Connecticut Academy of Sciences, V, pp. 178–257, with fourteen plates. Much of the material in this paper has been the subject of preliminary notices; *Stenoteuthis* n. g. for *Architeuthis megaptera* Verrill, and a large Bermudan squid, perhaps *Om. pteropus* Stp.; and *Lestoteuthis* for *A. kamschatica* Midd., from the North Pacific, are the only absolutely new names proposed here, but a large array of new facts, a thorough digestion of previous literature, a revision of the genera and a satisfactory illustration of the several species as far as known, give to the paper a monographic character. The principal among the species treated of and figured, are *Architeuthis harveyi*, *hartingii* and *princeps*, *Stenoteuthis megaptera*, *Histioteuthis collinsii* and *Enoploteuthis hartingii*, all of Verrill; *Architeuthis dux* and *monachus* of Steenstrup; and *Onychoteuthis robusta* Dall, the last being from the Aleutian islands. The paper will form the standard of reference for this interesting subject.

A synopsis of a lecture, by Professor A. Hyatt, given before the American Association, appears in the NATURALIST for December (p. 915–6); the subject being the transformation of *Planorbis*, as a practical illustration of the evolution of species. Although based on the study of the fossil forms of Steinheim, it is referred to here on account of its obvious bearing on the general subject.

A fully illustrated memoir on this subject is contained in the memorial volume of the Boston Society of Natural History.

In the NATURALIST (March, 1880), p. 207, Mr. R. Ellsworth Call has a note on reversed specimens of *Melantho* (*Campeloma*), and an examination of embryonic shells of several species, showing that from fifteen to twenty-five reversed specimens were found in every thousand, of which, however, it is believed by Mr. Call, only one-tenth per cent. survive to maturity. He suggests that the reversals may be due, as some other irregularities are, to crowding in the ovarian sac.

A circular has been issued by Messrs. R. E. Call and A. F. Gray, asking the coöperation of conchologists in providing material for a proposed monograph of the *Unionidæ* of North America, in which they propose to figure the anatomy of each species in detail.

The polymorphous forms of *Anodonta* found in the United States, are referred to in a note by Professor Call in the NATURALIST for July, p. 529. The existence, everywhere about us, of transition forms of animals, is now being generally recognized by naturalists, who formerly, under the blinding influence of the dogma of fixity in specific characters, wandered hopelessly from the extreme of naming every individual variation, to that of confounding every sort of minor characteristic under one specific name. Now that a certain amount of freedom in these matters has become habitual, we may look for the speedy recognition of the particular effects produced by at least the more simple features of the environment, of which several of our Western naturalists have already given us a foretaste.

In the AMERICAN NATURALIST for July (p. 522), R. Bunker notes that a specimen of *Lymnæa elodes* Say, from which a piece of shell the size of a half dime had been broken out, showed signs of reparation in three days, and in six weeks the injury was completely repaired, the mollusk meanwhile performing its usual functions in an aquarium.

In the AMERICAN NATURALIST for March (p. 214), Mr. Lockwood notes a case of extreme vitality in a specimen of *Helix aspera (aspersa?)*, which lived thirteen months without food.

Geographical and Bathymetrical Distribution and Catalogues.—A valuable contribution to our knowledge of the geographical distribution of invertebrates on the north-west coast of America, is made by Mr. J. F. Whiteaves in the "Report of progress of the Geological Survey of Canada, 1878–9," pp. 190 B—205 B, Montreal, May 1, 1880; his paper being entitled "On some Marine Invertebrata from the Queen Charlotte islands." It is based on collections made by Dr. G. M. and Mr. Rankine Dawson in the summer of 1878, on the eastern and northern coasts of the group. *Macoma carlottensis* Whiteaves, a species much resembling *M. iridescens* Sby., and *Lepton rude* (Dall MS.) are described and illustrated by good woodcuts. Many species in the list have hitherto been known only from more southern localities. The depth and exact locality are precisely indicated; the mollusk fauna, as might be expected, is distinctively Oregonian in character. Several new species of Echinoderms are described by Professor Verrill, and two species of corals, a *Balanophyllia* and *Paracyathus* are noted, the latter of which was only previously known from Monterey, Cal.

In the Proceedings of the Philadelphia Academy for the current year (pp. 40–127, pls. 1–8, IX–XVI), Dr. R. Bergh, of Copenhagen, concludes his memoir on the Nudibranchiate Gasteropod Mollusca of the North Pacific ocean, with special reference to those of Alaska. This, with Part I, noticed in our last report, completes the revision of the species known to exist in that region, and is, without doubt, the most important contribution to the subject ever published in America. Too crowded with anatomical and other details to admit of intelligible condensation in the form of an abstract, it may be mentioned that the species described by Cooper and others are here for the first time referred to their true systematic relations, and enumerated under their proper genera. Several European species are recognized, and others are represented by closely allied forms, nearly all are subjected to minute microscopic dissection and appropriately figured in detail from camera lucida drawings. The new species described in the second part, are *Akiodoris lutescens*, Aleutian islands; *Lamellidoris* (var.) *pacifica*, Bering sea; *L. varians*, Aleutians, and a variety of it; *L. hystricina*, same locality; *Adalaria pacifica* and *A. virescens*, Unalashka; *Acanthodoris cærulescens*, Bering sea; *Themisto (Palio) pallida*, Aleutians; and *Triopha modesta*, Shumagin islands, Alaska. For the last (at first referred to *Triopa*) the genus *Triopha* is proposed, and *Colga* is suggested for the group typified by *Doris lacera* Abildgaard (l. c. p. 112).

Brooks (Proc. B. S. Nat. Hist. XX, pp. 325–9) contributes a paper on "The development of the digestive tract in Mollusks," in which he records his views of the leading points in the develment of pulmonates and of the oyster from the observations given in detail in the subsequently published memoirs on the fresh-water Pulmonates and on the oyster, elsewhere referred to.

In the Annals of the N. Y. Academy of Sciences, I, No. 11, pp. 355–362, pl. XIV, XV, Mr. W. G. Binney continues his valuable investigations and notes on land shells of the United States, and on some exotic species. The following new species are described: *Macrocyclis hemphillii* (Olympia, Or.); *Zonites rugeli; Z. andrewsi;* and *Mesodon andrewsi*, from Roan mountain, N. C., collected by Mrs. Andrews. Notes on the anatomy and dentition as well as the synonymy of species already known, make up the balance of the paper. The genus *Tebennophorus* is now first reported from the Amazon, three hundred miles inland from Para, Brazil.

In the Bull. Mus. Comp. Zoölogy (VI, No. 3, Feb., 1880) the fifth report on the *Blake* dredgings in the Gulf of Mexico, comprises "General conclusions from a preliminary examination of the Mollusca," by W. H. Dall (pp. 85–93). The material considered embraced four hundred and sixty-two species of ninety-six genera (this term being liberally construed), ranging from a few fathoms to 1920 fathoms. A comparative table of the genera and number of species of the littoral and abyssal Gulf fauna is given, together with illustrations of the range of individual species, showing that many range from thirty fathoms to over eight hundred fathoms, a fact which had never been clearly indicated before, as most of the deep sea expeditions avoided carrying their investigations continuously from the abyssal into the littoral region. Pteropods and pelagic surface forms are not considered. The general conclusions are as follows: 1. The fact, already known, that certain species have a limited vertical range, forming respectively a littoral and an abyssal fauna, is supplemented by the hitherto unrecognized fact that a fair proportion have a vertical range including both regions. II. Of the species with great vertical range, the smallest part (ten per cent.) belong to boreal or cold water forms; the next larger (twenty per cent.) to tropical or warm water groups, while more than sixty belong to groups not specially characteristic of the *littorale* of either region. III. Of the species found in the abyssal region, without regard to their range above it, ten per cent. may be termed boreal, thirteen per cent. tropical, and more than seventy-five per cent, uncharacteristic generic forms. IV. Since the tropical forms found belong to the same groups as the local littoral mollusk fauna, it is eminently probable that the abyssal regions have local faunæ proper to their various portions, and that a universal exclusive abyssal mollusk fauna does not exist. V. The specific characters of many of the strictly abyssal species appear to exhibit a very remarkable degree of variation between supposed specific limits, though it would seem as if the conditions under which they live must be remarkably uniform. This would indicate that the tendency to variation is less dependent upon changes in the existing environment than has generally been assumed, if not entirely independent of it; and, conversely, that under uniform conditions (where there can be hardly any struggle for existence) the innumerable variations which occur may coëxist with hardly any elimination, and the equilibrium of characters made temporarily stable by natural selection (which constitutes "species") may fail to be exhibited to a sufficient degree to permit us to take account of it.

In the *American Journal of Science* for November (xx, pp. 390–403), Professor Verrill treats of the remarkable marine fauna occupying the outer banks off the southern coast of New England. This article is a preliminary to the more extended paper in the Proc. U. S. Nat. Museum, hereafter alluded to, and contains brief descriptions of two new genera and three new species of Cephalopods, one new Pteropod, seventeen species and one new genus of Gasteropods, and two of acephalous Mollusca. Several of these appear to be of particular interest, and some seem remarkably close to those described from the *Challenger* collection by Boog-Watson. The *Calliostoma bairdii* V. and S., is the *Calliostoma psyche* of the recorder, named but not described in his preliminary report on the *Blake* dredgings off the gulf and Florida coasts in deep water. This lovely species was dredged by the lamented Pourtalès many years ago on the Florida reefs. The species referred to in this article are, in part if not wholly, members of the deep sea fauna, strictly speaking. A number of the species mentioned in the article, are described as of "Verrill and Smith," in recognition of the labors of Mr. Sanderson Smith of the Fish Commission, upon the part of the collection embracing the Mollusca.

In the same journal (l. c., p. 284, April, 1880), Verrill gives a "Synopsis of the Cephalopoda of the north-east coast of America," with five plates. This is composed chiefly of notes or additions to knowledge in regard to species heretofore described.

In the Proc. U. S. National Museum (Vol. III, pp. 356–409), Professor Verrill publishes a "Notice of recent additions to the marine Invertebrata of the north-eastern coast of America, with descriptions of new genera and species, and critical remarks on others." This consists of two parts, the first (II) relating to the mollusks, with notes on annelids, etc., collected by the U. S. Fish Commission, and the second (III) comprising a catalogue of Mollusca recently added to the fauna of Southern New England. Although the latter part (pp. 401–409) did not appear until Jan. 10, 1881, the publication, which has also appeared separately, will here be considered as a whole, for the sake of convenience. Part of the new species had previously been published in the *Am. Journal of Science and Arts* for November, as already mentioned.

In this article one hundred and fifteen species of Mollusca are described as recent additions to the fauna of New England, which, almost without exception, have been obtained by the parties employed by the U. S. Fish Commission, directed by Professor S. F. Baird, and under the immediate supervision of Professor Verrill, who has been aided in the work by Mr. Sanderson Smith, Dr. A. S. Packard, Jr., Messrs. Richard Rathbun, H. E. Webster and several other well-known naturalists. Particularly rich results have been obtained in depths from sixty-five to five hundred fathoms, south from Narragansett bay extending to the margin of the so-called "coast shelf" of the continent in this vicinity, about ninety miles from the coast. It may be questioned whether all the forms obtained can be with entire accuracy denoted as belonging to the "New England" fauna, since some of them are, without doubt, members of the true deep sea fauna, and may be found hereafter to extend widely throughout the Atlantic sea-bed without truly forming part of any of the local faunæ bordering upon it. Among the surprises was the discovery, in some numbers, of nearly fresh shells of *Argonauta argo*, though Lockwood (AMERICAN NATURALIST, XI, p. 243, 1877) recorded the capture of a living individual, probably of this species, on the coast of New Jersey. The species first named in this paper are *Bela sarsii* V. (for *B. cancellata* Sars non Couthouy); *B. hebes* V. from 500 fms.; *Pleurotoma (Pleurotomella) pandionis* V., 238 fms.; *Taranis pulchella* V., 487 fms.; *Neptunea (Sipho) cœlata* V., and *N. arata* V., to 500 fms.; *Nassa nigrolabra* V., 155 fms.; *Lunatia levicula* V., 26 fms.; *Rissoa (Cingula) harpa* V., to 365 fms.; *Solarium boreale* Verrill and Smith, 115 fms.; *Acirsa gracilis* V., 100 to 365 fms.; *Aclis striata* V.; *Turbonilla smithii* V., 100 to 120 fms.; *Odostomia (Menestho) sulcata* V., 365 fms.; *Dendronotus elegans* V.; *Polycerella emertonii* V. n. g. et sp.; *Coryphella nobilis* V.; *Cratena veronicæ* V.; *Halopsyche* V. n. g., for *Psyche* Rang., preoccupied; *Lyonsiella gemma* V., 487 fms.; *Neæra multicostata* Verrill and Smith; *Avicula hirundo* L. (?) var. *nitida* V., and several undetermined species. It is of course impossible, within the limits of this report, to summarize fully a publication which is in itself chiefly a summary and a catalogue, nor is it possible fairly to criticise species or identifications from brief diagnoses without figures. It is to be hoped that the authorities of the Fish Commission and Professor Verrill will not allow much time to pass without giving to students good figures of all these new forms, which have been, during the existence of the Commission, from time to time necessarily so briefly and imperfectly described. This is the more necessary now that the investigations of the Commission are encroaching upon the abyssal fauna. Naturalists in several countries are working on similar material, and it is growing to be more and more widely recognized that a description, unless accompanied or soon followed by a good figure, or careful comparison with some well-known and well-figured form, is useless to any one who does not possess specimens for comparison. That the labors of Professor Verrill and his associates should bear their proper fruit and be placed permanently on a sound foundation, must be the wish of every American naturalist, and to bring this about, good figures of their hard earned treasures are indispensable.

One criticism may be permitted. The *Bela simplex* of G. O.

Sars being neither the *B. lævigata* Dall (from Bering strait), nor the *Pleurotoma simplex* of Middendorf, the identification of the species recorded under Sars' name may be considered as still in doubt.

In the November number of the *Valley Naturalist*, Mr. Calkins enumerates twelve species of mollusks additional to his list of marine shells of Florida of 1878.

Some notes on the molluscan fauna of Dominica, are given by A. D. Brown, in the AMERICAN NATURALIST (Vol. XV, No. 1, pp. 56–7), and relate chiefly to the land shells. Mr. Guppy's publications (*Ann. Mag. Nat. Hist.*, 1868) are criticised, and it is stated among the notes that *Amphibulima patula* possesses the power of completely contracting itself within its shell.

A list of "Land and fresh water mollusks of Muscatine county, Iowa," was printed, in 1879, in the History of Muscatine county, (8vo, 1879, pp. 332–3) by Professor F. M. Witter, who also printed a tract of four pages entitled, "Notes on Wyoming Hills," a paper read before the Muscatine Academy of Science, June 2, 1879, which includes notes on various species of recent and subfossil Pulmonata. These publications have not been seen by the recorder.

In the report of the work in 1879 (p. 434) reference was made to a criticism in *Science News*, by Mr. Stearns, of a paper on the shells of Florida by Mr. Calkins. In the same (now defunct) publication (June 15, '79, p. 255), Mr. Calkins replies, maintaining the probable accuracy of the disputed identification of a Floridian *Ranella* collected by him with *R. muriciformis* Brod., a West American species, rather than with *R. caudata* of Say, as Mr. Stearns would suggest.[1]

It seems that there were also published by Mr. Calkins, in 1879, the following papers: "The terrestrial molluscan species of Florida, with notes of personal observation," in the Journal of the Cincinnati Society of Natural History in 1879, and "Note on a rare Californian marine mollusk," in *Science News* of July, 1879.

During the summer of 1880, Mr. T. A. Verkruzen visited the Banks and Newfoundland, and dredged there, beside collecting from several other sources, such as cod stomachs, etc. He pub-

[1] The specimens from Florida having been kindly submitted to the recorder by Mr. Calkins, and compared with authentic specimens of *R. muriciformis*, seem to be specifically different from that Pacific coast species, though belonging to the same general group, and, in general, not dissimilar in characters.

lishes in the January number of *Jahrbuch d. Deutschen Mal. Ges. f.* 1881 an account of his collections. Herein appear descriptions of several forms of *Buccinum*, which no one of our American students has yet thought of separating under a specific name, though very familiar to all. The limitations of species varying with different writers, it is sufficient to say that in this case specific limits seem to be contracted beyond precedent. None of the forms are figured and described but have been already several times named, according to the average view of such things. The figures are fortunately very good.

Introduced Species.—W. H. Ballou (AMERICAN NATURALIST, July, p. 523) states that *Bythinia tentaculata* L., was discovered at Oswego, N. Y., in June, 1879, and has more recently been found in the Champlain canal, at Waterford and Troy, and in the Erie canal, at Syracuse, N. Y.

Verrill (Proc. U. S. Nat. Mus., III, p. 376) notes the occurrence at Newport, R. I., among the docks, of *Truncatella truncatula* Drap., with *Alexia myosotis*, *Assiminea grayana*, etc., in July.

Professor E. S. Morse, in the Bulletin of the Essex Institute (Vol. XII, 1880, Salem, Mass.), has a paper of six pages on "The gradual dispersion of certain mollusks in New England." In it some statistics are given as to the gradual spread of various species, especially *Litorina litorea* L., together with a small map and a figure of the shell.

In the *American Journal of Science* among the zoölogical notes, Professor Verrill alludes briefly (l. c. p. 250, Sept., 1880) to the occurrence of *Truncatella truncatula* and *Assiminea grayana*, at Newport, R. I. (The recorder believes that in 1871, during a brief visit to Wood's Holl, Mass., he obtained a few dead specimens of the former on the beach at that place; at least the specimens agreed with European specimens so named, so far as the shell was concerned.)

Another note (l. c. p. 251) refers to the rapid diffusion of *Litorina litorea* L., on our coast, this species having now reached as far south-west as New Haven, Conn.

In the *Valley Naturalist* (St. Louis) II, 1, Sept., 1880, Mr. L. B. Case speaks of the prevalence of *Zonites cellarius* Müll., in greenhouses, where, however, it is not ascertained to do any damage; unlike an unidentified imported species of *Limax*, which is very destructive to Begonias and other tender-leaved foliage plants.

It may be noted that *Zonites* may be beneficial by destroying the Limaces, as it is believed to be carnivorous.

Descriptive and Miscellaneous Papers.—Very few exclusively of this character have been published during the year, although, as usual, several noted under previous heads, contain descriptive matter.

Octopus obesus and *O. lentus* are described by Professor Verrill as new to the north-east American coast (*Am. Journ. Sci.*, Feb., 1880, XIX, pp. 137–8) from specimens obtained by fishing vessels off Sable island and Le Have bank, and presented by their commanders to the U. S. Fish Commission.

Partula mooreana, from the Island of Moorea in the Pacific, is described as new by Dr. W. D. Hartman (Proc. Acad. Nat. Sci., Phil., 1880, p. 229).

In the *Valley Naturalist* (St. Louis) II, I, Sept., 1880. p. 6, Mr. Calkins describes *Amnicola ferruginea* n. s., from the Calumet river, Ill., with a woodcut, and gives some "Notes on some Florida Uniones," in which he unites *Unio buckleyi* and *U. buddianus* Lea, specifically, beside considering the distribution of a nearly allied form, *U. blandingianus* Lea. In the December number (p. 53), he describes, with a good figure, *Zonites upsoni*, a new minute and interesting species from Illinois. Mr. Calkins also printed in July, 1880, an octavo catalogue of the Uniones in his cabinet, which comprises some four hundred numbers.

At the meeting of the Am. Assoc. for the Adv. of Science, at Boston, papers were read by Professor E. S. Morse entitled, "Observations of Japanese Brachiopods," and "Notes on Japanese Pulmonifera," but the reporter has not come across, as yet, any published synopsis of these papers, which it is to be hoped will appear in the annual volume.

Professor Alpheus Hyatt, in one of the Teachers' Science Guides (Ginn & Heath, Boston, 1880), has given an account of some of our commoner, economically important mollusks, such as the oyster and clam.

A book, by Mr. Emerton, on the animals of the sea-shore, which (like that of Professor Hyatt just referred to) has not been seen by the recorder, may contain some matter pertinent to this record.

Articles on the economical mollusks appear from time to time in the daily or weekly press. Some of these contain matter worthy of preservation in more permanent form. Among those of this general nature, which have come under our observation during 1880, the following may be noted: *N. Y. Weekly Herald* of May 1st, On the Oyster business; *San Francisco Weekly Bulletin* Sept. 15th, On Oysters of the Pacific coast and the trade in them; the same Dec. 1st (in eastern correspondence), On the Oyster trade of Baltimore. In the *San Francisco Morning Call*, Dec. 1–12, 1880, appeared a series of letters on Mexican oysters and the possibility of utilizing them, attempts at which, from the vexatious customs regulations of Mexico, and the stupidity of the local officials who enforce them, have hitherto resulted in failure, though the oysters are easily obtained and of good quality.

The collections of shells belonging to various gentlemen in the vicinity of San Francisco, and especially that of Mr. R. E. C. Stearns, perhaps the most scientifically valuable of any *private* collection in the United States, form the subject of an article in the *Sunday Chronicle*, San Francisco, Dec. 26, 1880.

Two papers of real value on "Staten island and oysters," appeared in the *Scientific American* for July 31st and Aug. 7th. In the supplement to that publication for July 10th, J. W. Putnam, C. E., contributes an important essay on the preservation of timber, especially with reference to attacks by boring mollusks such as the Teredo.

The recorder may, perhaps, be permitted here to announce that having discovered that the name *Ceropsis*, used by him for a genus of Carditidæ of the Californian coast, in 1871, is preoccupied, he desires to substitute for it the name *Milneria*, in honor of the late Dr. J. W. Milner of the U. S. Fish Commission. The name *Candelabrum* (used by him in 1878 for a Pleurotomoid genus having the posterior surface of the whorls concave, and with the keel produced backward in spines like those ornamenting the varices of *Murex*), appears to have been used by Blainville for a radiate, but it does not appear whether Blainville's name has or has not been adopted into science. If a new name be considered desirable, *Ancistrosyrinx* may be used. It comes from deep water off Florida.

NOTES ON THE CODEX TROANO, AND MAYA CHRONOLOGY.

BY DANIEL G. BRINTON, M.D.

THE investigations of Professor Thomas, published in the AMERICAN NATURALIST for August, go far towards dispelling the obscurity which has hitherto rested on this interesting document. In examining its pages some other suggestions have occurred to me which may throw further light on its object and contents.

One question in reference to it is, as to what precise period of time it refers. Up to the present there has been no opinion expressed upon this point, but I think it can be approximately if not definitely determined.

To do so we must decide what was the length of an Ahau. It is true that all the old authors, Landa, Cogolludo, Beltran, Lizana and the Maya chronicler, speak of it as a period of twenty years; and the most recent writer on the subject, Dr. Valentini,[1] insists on this being the proper length. On the other hand, we have the profound Maya scholar, Señor Juan Pio Perez, who very positively maintained that it embraced twenty-four years, only twenty of which, however, were counted, the remaining four being considered "intercalary, and, as it were, non-existent." Although no reason whatever for this odd arrangement has been proffered, I am convinced that Perez is correct, and in addition to the valuable corroborative testimony adduced by Professor Thomas, I shall bring forward a calculation which some time ago dispelled any doubts I had on the subject.

As the Kin Katuns, or periods of 52 years, recurred so frequently that after a few generations they could not be distinguished one from the other, and would thus have led to great confusion in chronology, the Ahau Katun was devised, embracing the much longer period of 312 years, and to it was referred any important event in history. Instead of its purpose being "further to complicate the calendar and to deceive the people," as Professor Thomas thinks, it is, when properly used, an extremely simple and easy means of keeping the run of the years, and converting the one computation into the other. For this purpose the series of numbers was used which has been such a mystery to antiquaries: 13, 11, 9, 7, 5, 3, 1, 12, 10, 8, 6, 4, 2.

[1] "The Katuns of Maya History," 1880.

Gallatin explained them as the numerical characters of the days "Ahau" following the first day of each year called Cauac;[1] Dr. Valentini thinks they refer to the numbers of the various idols worshiped in the different Ahaus; Professor Thomas that they are the number of the year (in the indiction of 52 years) on which the Ahau begins. Each of these statements is true in itself, but each fails to show any practical use of the series; and of the last mentioned it is to be observed that the objection applies to it that at the commencement of an Ahau Katun the numbers would run 1, 12, 10, 8, etc., whereas we know positively that the numbers of the Ahaus began with 13 and continued 11, 9, 7, 5, etc.

The explanation which I offer, is, that the number of the Ahau was taken from the last day Cauac preceding the Kan with which the first year of each Ahau began—for, as 24 is divisible by 4, the first year of each Ahau necessarily began with the day Kan. This number was the "ruling number" of the Ahau, and not for any mystical or ceremonial purpose, but for the practical one of at once and easily converting any year designated in the Ahau into its equivalent in the current Kin Katun, or 52 year cycle. All that is necessary to do this is to *add the number of the year in the Ahau to the number of the year Cauac corresponding to this "ruling number." When the sum exceeds 52, subtract that number.*

Take an example: To what year in the Kin Katun does 10 Ahau XI (the 10th year of the 11th Ahau) correspond?

On referring to a table, or, as the Mayas did, to a "Katun wheel," we find the 11th Cauac to be the 24th year of the cycle; add ten to this and we have 34 as the number of the year in the cycle to which 10 Ahau XI corresponds. The great simplicity and convenience of this will be evident without further discussion.

I now pass to the important question: Can we establish a correct correspondence between the Kin Katuns and the Ahau Katuns with the years of the Christian era?

The attempt has been made with widely divergent results. Perez makes the 13th Ahau begin in 1488, and Gallatin follows him; Valentini has it begin in 1522, but he makes the serious error of supposing the 13th was the *last* Ahau, whereas it was

[1] Trans. Am. Ethnol. Soc., Vol. 1, p. 109.

the *first* in the Ahau Katun; besides attributing only twenty years to the Ahau. That both these suppositions are erroneous, will appear by an analysis of a date which has been given us by a Maya writer preserved by Perez and referred to by Professor Thomas. This date is that of the death of Ahpula. A false translation of this important quotation, led Gallatin to suspect an error in the original; but it is entirely correct and intelligible as it stands. The text runs thus:

"In the 13th Ahau Chief Ahpula died. Six years were wanting to complete the 13th Ahau. This year was counted towards the east of the wheel, and began on the 4th Kan. Ahpula died on the 18th day of the month Zip, on the 9th Imix; and that it may be known in numbers it was the year 1536."

Side by side to this must be put a very precise date given by Bishop Landa, and corroborated by native writers. It is to the effect that "the Spaniards arrived at the city of Merida in the year of the nativity of our Lord 1541, which, said the Indians, was precisely in the first year of the period of Eleven Ahau."

Here, then, are two dates which should be reconciled. It looks difficult, at first sight. Counting six years back from 1541, brings us to 1535, not 1536, and Valentini therefore supposes that the Maya chronicler had in view the official incorporation of Merida (Jan. 6, 1542)—though what that would have had to do with the fixed principles of Maya chronology, he does not make clear.

In reality, there is no contradiction at all. The Maya year did not begin January 1 as does ours, *but July 16*, at or about the time of the transit of the sun by the zenith in the latitude of Merida. Hence the Maya chronicler identified the 6th year from the end of the Ahau with 1536, because the greater part and the latter part of that Ahau year was actually in A. D. 1536. In point of fact, Chief Ahpula, whoever he was, died Sept. 11, 1535, O. S.

Having fixed this date beyond peradventure, I shall take another step. The Ahau Katun of 312 years, divided into 13 periods of 24 years each, embraces 6 Kin Katuns of 52 years each; yet owing to the properties of the different numbers, the first year of any Ahau will not coincide with the first year of any Kin Katun except at the beginning of the Ahau Katun; and from the date of this coincidence the Ahaus were reckoned *beginning with the 13th* (as Perez positively and correctly states).

Referring again to Chief Ahpula's death, the chronicler states that it occurred not only in the 6th year from the close of the Ahau, but he also gives it in the Kin Katun reckoning as the year 4 Kan. Now it is obvious that if Ahau XIII is the first of the greater cycle, the number of the year referred to should be the same as the number of the year 4 Kan in the lesser cycle—a coincidence which could not occur except in the first Ahau of the Katun. In fact, 4 Kan is the 18th year of the Kin Katun; and of course 24 — 6 = 18, the year of the Ahau.

This leads to the result that the coincidence above referred to, which marked the beginning of the greater cycle, occurred July 16, 1517, on which day, for the first time for 312 years, the current Ahau und Kin Katun both began on the day 1 Kan.

With this date thus definitely fixed, it would be easy to construct a table showing the correspondences of the Maya and Christian systems of reckoning. I shall pass, however, to its application to the Codex Troano.

Leaving aside the opinion of the Abbé Brasseur that this manuscript is a sort of geological treatise, and that of Mr. Bollaert that it is a history, all unprejudiced students have agreed that a portion of it at least is a calendar—what the Mayas called *tzolan Katun*, the arrangement of the Katuns or divisions of time, and probably also a *tzolanté*, ritual. The left hand columns of the four plates numbered XXIII, XXII, XXI, XX, as has been noted by Professor Thomas, enumerate a series of 52 years beginning with 10 Cauac, which is the 36th year of the Kin Katun. Could we find anywhere on these plates the number of the Ahau, there would be no difficulty in fixing the exact date of the manuscript. I have no doubt that Professor Thomas is right in believing that the Ahau is indicated in the upper compartment of Plate XXIII; and I had repeatedly sought to make it out there before seeing his article; but unless it is the figure two in red at the top of the column of numbers to the right of the figures in blue, I cannot discern it. Assuming that the date is Ahau II, and the year 10 Cauac, it is obvious from the method of calculating above given that the year with which this calendar begins is that which corresponds to July 16, 1500–1501, and that it ends on the year 9 Ix, Ahau XI—July 16, 1552–1553.

Passing by various other considerations of interest in connection with the Codex, I shall offer one suggestion which, so far as I know, has not heretofore been made.

It is known to all students of the subject that there is no account of the plan adopted by the Mayas to arrange their intercalary days. That they did allow for these days is asserted by all authorities; if they had not done so, they would, as Gallatin observes, have been out of their reckoning twenty days every eighty years; whereas we know that they were only forty-eight hours astray in the time of the transit of the sun by the zenith at the time of the Conquest (Pio Perez).

Their method of intercalating is, I believe, illustrated by the Codex Troano. One of the most instructive pages of that manuscript, is the title page. Were it fully deciphered, we should doubtless have a key to the whole work. It is composed of eleven lines across the page, each presenting either seven numbers or seven figures. The first row from the top of the page is partly erased, but may readily be restored.[1] It represents the hieratic signs of the seven days:

Ymix, Ix, Akbal, Kan, Chicchan, Cimi, Manik.

Below them stand the numbers:

1, 2, 3, 4, 5, 6, 7.

Now of these days, the first three named—Ymix, Ix, Akbal—are the *last* of the series of 20 which make up the Maya month, while the remaining four are in their order, the *first* of the month.

This serves to identify the kind of book the Codex is, for Landa has, among his other obscurities about the Maya calendar, this particularly obscure passage:

"It is curious to note how the dominical letter [of the year] always comes up at the beginning of its year, without mistake or failing, and that none of the other twenty letters appears. They also used this method of counting in order to derive from certain letters a method of counting their epochs and other things, which, though interesting to them, does not concern us much here. It is enough to say that the character or letter with which they begin their computation of the days or their calendar is called *One Ymix* which is this [Sign of day.] which has no certain nor fixed day in which it falls. Because each one changes its

[1] The reasoning of Professor De Rosny on this point is conclusive. See his "Essai sur le Déchiffrement de l'Ecriture Hiératique de l'Amérique Centrale." Folio, Paris, 1876, p. 26.

position according to his own count; yet for all that, the dominical letter of the year which follows does not fail to come up correctly."[1]

This certainly is not to be understood, as has been supposed by M. de Charencey, who has made some excellent studies on this Codex, to mean that the year began with the day Ymix.[2] The contrary is distinctly affirmed by Landa. The true explanation I take to be the following:

Each period of 13 years began with the day 1 Kan, and, counting 365 days to the year, ended on the day 13 Cauac. In each period there should be three intercalary days, every fourth year being properly a leap year. These three days are allowed for by beginning the next subsequent 13 year period, not on the day following 13 Cauac in regular order, but by starting the almanac of the period with Ymix, thus allowing three days to elapse, which would bring 1 Kan of the new year in its proper astronomical position within about half an hour.

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EDITORS' TABLE.

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

—— It is refreshing to the ordinary plodding scientific mind, trammeled by the clogs and chains of the inductive method, to read the addresses of some (by no means the majority) of the metaphysicians of the Concord Summer School of Philosophy. Aiming his *a priori* gun at the human soul, Dr. Jones brings it down at the first shot, stuffs it with the Platonic philosophy, and finds, after all, that "the soul exists only as *objectivation*, manifesting itself out of itself." We on the whole prefer this to the degrading conception of the materialists and nescientists who are said to teach that the soul is a function of the brain, as it is really a definition we can understand. We quoted Carlyle's opinion of evolution in a recent number; here is Dr. Jones' deliberate characterization of the evolution theory, doubtless the result of years of scientific research and philosophic induction: "Of the idea of evolution and of the origin of the species, we must think some worthier thought than that of a monkey or gorilla rubbing off his tail and otherwise improving his condition, until, through natural

[1] "Relacion de las Cosas de Yucatan," p. 236.

[2] "Recherches sur le Codex Troano," p. 10, 1876.

selection of condition, he finds himself a spiritual being with an immortal soul." This statement of the evolution theory, which, for intelligence, matches the above quoted definition of the soul, was, so far as we are told to the contrary, received with applause (clapping and stamping is frowned down at the school as materialistic) of the silent sort, as befits a band of Hegelians and Super-platonists. It is currently reported, though the newspapers don't even whisper the idea, that after adjournment each evening the soul of each member of the school "retires into the occiput," where it lies in a trance for the night, contemplating the "*Thingness of the Here.*" Compare these dark orphic sayings and these aspirations of the souls of the Concord Philosophers with the materialistic methods of research of the anatomist or biologist or physicist, and who wouldn't be a Hegelian and Super-platonist!

Dr. Jones, full of anti-"materialistic" ardor, says in another place, "There are no natural forces; matter is inert; the potencies of nature are in spirit, not in matter." Another speaker remarked that "materialists are studying the lower forms of men, and avoid the higher civilization." The venerable Mr. Alcott, returning to the evolution theory, held that "instead of coming up from animals, animals have descended from men, and were possible only because man made himself a beast first." The more liberal and critical mind of Professor Harris, the able and learned editor of the *Journal of Speculative Philosophy*, led him to mildly rebuke these excesses of the transcendental philosophy, and he appeared to look with favor upon the doctrine of evolution, saying, "The descent of the soul does not explain the ascent. If God chooses to make man through matter, or even the ape, that involves no difficulty, for the ape is not man, and has no language nor ideas. Man is none the less made by God by being made through low material forms."

In all seriousness, we would not wish to appear to be making light of genuine philosophic methods, nor of the larger proportion of the noble, inspiring addresses and sentiments of the members of the Concord School of Philosophy. Every scientist is brought face to face with inscrutable problems. Few of them are thoroughgoing materialists as such. The great lesson of science is to teach us to suspend our judgment and to wait for more light, even if the solution of many problems has to be deferred for generations. Least of all can ultimate questions be solved by *a priori*, transcendental obscurities. Meanwhile the scientist warmly repels the charge of materialism, while spending his strength in endeavoring to discover the origin and source of man's physical and intellectual as well as moral nature, and for the present refrains from groundless generalizations on ultimate problems, which he may justly claim that the human mind is no better fitted for solving now than in the days of Plato and Aristotle. Is not this as truly the evidence of a well-trained, philosophic mind as the utterances of certain illiberal, one-sided philosophers who make a specialty of the writings of some schoolman rather than of the nature of their own mind, and who evince their ignorance and want of appreciation of science and scientific theories or working hypotheses, by dismissing them as "materialistic" and "atheistical." Scientific men are too apt to be dogmatic and censorious in dealing with transcendental and mystical philosophy, but we do not look for this spirit in the philosopher, whose range of vision takes in matter as well as mind and spirit.

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RECENT LITERATURE.

REPORT OF THE STATE COMMISSIONERS OF FISHERIES OF PENNSYLVANIA.[1]—This is the most extended report yet made by the commissioners, covering 151 pages of text, and containing forty-nine engravings, of which forty-four represent species of fishes. Fifty-eight pages are devoted to the results of pisciculture, by the commissioners, and the remainder to a systematic account of the fishes of the State by Professor Cope. The distribution of fishes from the two hatching houses, the eastern and western, has been considerable, and has extended to all parts of the State. There have been sent from the Western house at Corry, Erie Co., *Salmo fontinalis*, *S. salar sebago*, and *S. quinnat*. From the Eastern house at Marietta, Lancaster Co., the same species have been sent, together with *Clupea sapidissima* (shad), *Micropterus salmoides* (black bass) and *Cyprinus carpio* (carp). The most extensive distributions have been of trout and black bass. An important feature of the report is a series of answers to questions propounded by the commissioners as to the condition of the streams in various parts of the State. These inquiries relate to the obstruction, pollution, etc., of the waters, and the answers throw much light on the subject. They should be continued in future years, for the destruction of the fish population of many fine streams will be accomplished, if this matter is not carefully supervised by the commissioners, and the needful legislation carried into effect.

The ichthyological portion of the report includes descriptions of one hundred and fifty-seven species, of which four have been introduced. The descriptions are arranged under the various systematic heads of genera, families, and orders, for which characters are given in accordance with the views of the author. Professor Cope has been a student of this subject for many years, and he has made a good many important discoveries in a field already pretty well occupied. Such may be considered the finding of the genera *Placopharynx*, *Ericymba*, and *Labidesthes*. So also the peculiar arrangement of the intestines in *Campostoma*, where they

[1] Harrisburg; Lane S. Hart, State Printer, 1881.

are wound in a long helix round the swim-bladder. The determination of the structure of the jaws and their functions in the peculiar genus *Exoglossum* was first made in Professor Cope's paper on the Cyprinidæ of Pennsylvania, published in 1861. Professor Cope thinks that additional species will be found in the Ohio tributaries, which now includes half the fresh water fish fauna of the State. The eastern limit of distribution of a number of species is pointed out, and the southern limit of others.

The report contains a great many typographical errors. This is too common in the documents published at our State capitals, and suggests a greater interest in the emoluments of their office than the quality of the work done by the State printers. We know of a case in an adjoining State, where the official whose report was thus mangled, reprinted part of it at his own expense, rather than present the work to the public eye. We were of the opinion at the time that the expense should have been borne by the State printer.

We hope the commissioners will persevere in their work until all our fresh waters furnish a permanent supply of good fish food for our rapidly increasing population.

STUDIES FROM THE BIOLOGICAL LABORATORY OF JOHNS HOPKINS UNIVERSITY.[1]—While this part contains valuable physiological papers by the editor, Prof. Martin, and by Drs. Councilman, Hartwell, and Sewall, we propose to notice here the purely zoölogical memoirs, which are of a high order of merit. In Dr. S. F. Clarke's paper on the early development of the Wolffian body in the common salamander *(Amblystoma punctatum)*, which is illustrated by three well drawn plates, the author states that this body arises from the outer layer of the mesoderm as a solid rod of cells, and is at first largest anteriorly; a split then occurs in the larger portion which begins at the posterior end of the smaller part and travels anteriorly, and at this time a lumen has appeared in the anterior end of the blastema; finally, the split reaches the anterior end thus dividing that portion into two ducts; the lumen is extending itself backward, a small rod of cells has been formed below the anterior end of the ventral duct, the dorsal and ventral ducts are united at one point, and a second opening into the body-cavity from the dorsal duct has been made. This method of development seems to be quite different from that in any allied forms in which the development has been worked out, and, adds Dr. Clarke, it is most like that of the Elasmobranchs.

A paper by Dr. C. Sihler, on the formation of dentine and of osseous tissue is followed by one by Prof. W. K. Brooks and E. B. Wilson on the first zoëa of Porcellana, illustrated with two

[1] *Johns Hopkins University, Baltimore.* Studies from the Biological Laboratory. Editor, H. NEWELL MARTIN; Associate Editor, W. K. BROOKS. Vol. II, No. I. Published by N. Murray, Johns Hopkins University. June, 1881. 8vo, pp. 134. Subscription price for the vol., $5.00.

plates. It is devoted to a description of the first stages of the larva, the specimens having been hatched from the eggs at Beaufort, N. C. It appears that the larva immediately after hatching is still quite rudimentary in form compared with the more active zoëa after it has cast its first larval skin, which occurs in from two to twenty-four hours after hatching. A second paper by Dr. Brooks is entitled "Alternation of periods of rest with periods of activity in the segmenting eggs of Vertebrates."

HAMLIN'S PHYSICAL GEOGRAPHY AND GEOLOGY OF MT. KTAADN.[1] —This little known and somewhat inaccessible mountain, is one of the grandest peaks in Northeastern America. Its isolation, the great height to which it rises above the surrounding country, the wild, savage desolation of its summit, the sharpness of its peak, the enormous chasm or rent in its side like the crater of a volcano, are features wanting in the White and Green mountains. Moreover it is of peculiar interest from the fact that during the glacial period its peak, like that of Mount Washington, probably stood above the ice sheets, while at an elevation of 4615 feet on its sides, occur boulders of Oriskany sandstone containing fossils, as well as of fossiliferous slates which, in some manner unexplained, have been carried from the lowlands not many miles to the northwestward, apparently not much over 600 feet above the sea. Professor Hamlin's account is full and detailed, and we are glad to know only preliminary to more thorough investigations. The excellent heliotype of a model made of the mountain, will be useful to future explorers and visitors to this wildest, most volcanic-looking of our New England peaks.

Professor Hamlin, from numerous soundings in the lakes of the Ktaadn region, shows that the lakes are shallow, with flat bottoms, enclosed by glacial detritus, as are all the lakes in Maine. Of lake basins excavated in solid rocks, he knows not an instance in Maine. It would seem from this that the lake basins of Maine, though our author does not say so, would, if drained, appear like the ancient lake bottoms which form the sites of many a New England village, and which were formed during the terrace epoch or epoch of great rivers, when the latter were chains of lakes.

The author shows that the Ktaadn region is not a continuous granite area as formerly supposed, but that like the other elevations in Central Maine, it is a mass of intrusive granite rising out of gneiss. He takes the ground, against Sterry Hunt and others, that the "gneiss" is really an eruptive granite, rather than of sedimentary origin, the transitions in many places within a

[1] *Observations upon the Physical Geography and Geology of Mount Ktaudn and the adjacent district.* By C. E. HAMLIN. Bulletin of the Museum of Comp. Zoology at Harvard College. Geological series, Vol. I, No. V. Cambridge, Mass., June, 1881. 8vo, pp. 189–223, with a map and heliotype taken from a model of Mt. Ktaadn.

small area from crystalline rock to distinct schists being, in his view, incompatible with the idea that the former is a metamorphosed portion of the latter. Ktaadn is itself composed of true granite, specimens having been referred to Dr. Wadsworth for microscopic examination. The mountain has been determined, by Professor Fernald, to be 5215 feet high; the parallel of 46° crosses the northern base of the mountain. The drift, boulders and gravel occur as far up as 4600 feet on the sides of the mountain; the drift has been covered with the débris from the mountain summits, or in the author's words, "Ktaadn has thus been buried under its own ruins, and beneath these ruins has been hidden the drift that was deposited when the mountain was comparatively intact."

Darwin's Power of Movement in Plants.[1]—There are few botanists indeed who do not prize very highly Mr. Darwin's botanical works—"Climbing Plants," "Fertilization of Orchids," "Insectivorous Plants," "Fertilization in the Vegetable Kingdom," and the "Forms of Flowers." We have now another to add to the list, and it is not too much to say that it fully equals in interest and importance, any of its predecessors. Like them it is the record of a long series of the most patient and painstaking observations and direct experiments, and like them the results are told in the simple and straightforward manner which is the peculiar charm of Mr. Darwin's writings.

Beginning with a short introduction, the authors take up the circumnutating movements in seedling plants, devoting particular attention to the movements of the radicle, or young root, and the cotyledons, or earliest leaves of the plantlet. Curious and ingenious devices were resorted to, for showing the periodic movements of circumnutating parts, and numerous diagrams are given, showing the paths traversed during stated periods. Not only were the parts of the young plantlet found to have periodic movements, but, in many cases at least, they were found to be sensitive to contact or other external influences. The movements of the parts of mature plants are next taken up, and many curious facts are brought out here for the first time. The movements connected with the sleep and waking of plants occupy considerably more than one hundred pages of the book. Heliotropism and its modifications occupy seventy pages or more, and geotropism upwards of fifty more. At the close is a chapter containing a summary which includes some startling suggestions, and food enough for many years of diligent and hard thinking.

The public on this side of the Atlantic, have again to thank the Messrs. Appleton & Co., of New York, for the promptness with which they have brought out the American edition, and at a price which places it within easy reach of all.—*C. E. B.*

[1] *The Power of Movement in Plants.* By Charles Darwin, LL.D., F.R.S., assisted by Francis Darwin. New York, D. Appleton & Co, 1881.

RECENT BOOKS AND PAMPHLETS.—Dr. H. G. Bronn's Klassen und Ordnungen des Thier-Reichs, Wissenschaftliche dargestellt in Wort und Bild. Fortgesetzt von Dr. A. Gerstaecker, Professor an der Universtät, Fünfter Band, II Abtheilung. Gliederfüssler; Arthropoda 1, 2, 3, Lieferung. Roy. 8vo, pp. 96, VIII plates. Leipzig und Heidelberg, 1881.

Dr. H. G. Bronn's Klassen und Ordnungen des Thier-Reichs, Wissenschaftliche dargestellt in Wort und Bild. Fortgesetzt von C. K. Hoffmann, Doctor der Medicin und Philosophie, Professor in Leiden. Sechster Band. III Abtheilung. Reptilien 18, 19, 20 und 21, Lieferung. Royal 8vo, pp. 27, IX plates. Leipzig und Heidelberg.

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Memoria Botanica Sobre el Embarbascar O Sea. La Pesca por Medio de Plantas Venenosas. Por A. Ernst. (Del Tomo 1 de los esbrozos de Venezuela. Por A. A. Level.) 8vo, pp. 16. Imprenta Bolivar, 1881, Caracas. From the author.

Las Familias mas Importantes del Reino Vegetal especialmente las que son de interes en la Agricultura e industria, O que estan representadas en la Flora de Venezuela, Resumen del curso de Botanica sistimatica, leido en la Ilustre Universidad central. Por A. Ernst. 8vo, pp. 82. Imprenta de espinal e Hijos, Caracas, 1881. From the author.

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Leucifer; a study in Morphology. By W. K. Brooks, associate in biology and director of the Chesapeake Zoological Laboratory of the Johns Hopkins University, Baltimore, Md., U. S. A. Communicated by Professor Huxley, Sec. R. S. Received April 6, 1881. From the Proceedings of the Royal Society, No. 212, 1881. 8vo, pp. 2. London, 1881. From the author.

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GENERAL NOTES.

BOTANY.[1]

Botany in Minnesota.—The University of Minnesota opened, during July, a Summer School of Science, in which instruction by lectures and laboratory practice was furnished in chemistry (Professor Dodge), geology (Professor Hall), and botany (Professor Bessey). About forty teachers enrolled themselves for the courses. The botanical laboratory, supplied with twenty-five microscopes, was open from 9 A.M. to 5 P.M., excepting the lecture hour, from 11 to 12 o'clock. The Mississippi river, above and below the falls of St. Anthony, and the long cañon, with its high cliffs, extending from the falls to Fort Snelling, together with the innumerable lakes in the vicinity of Minneapolis, supplied an abundance of material for study. The cooler climate of Minnesota made work possible even in the heated term of this ever-to-be-remembered July. The laboratory course may be given in outline as follows: I. *General Histology of Plants.*—Protoplasm in hairs and tissues, cells, cell walls and their markings, chlorophyll, starch, plant crystals, parenchyma, collenchyma, sclerenchyma, fibrous tissue, laticiferous tissue, sieve tissue, tracheary tissue, epidermis, stomata, hairs, fibro-vascular bundles. II. *The Structure and Physiology of Cryptogams.*—(1) The Sexless Plants (Protophyta) Protococcus, Nostoc, Oscillatoria, Rivularia, yeast plant, Bacteria; (2) The Unisexual Plants (Zygosporeæ), Hydrodictyon, Conferva, Desmids, Diatoms, Spirogyra, Mucor; (3) The Egg-spore Plants (Oösporeæ), Œdogonium, Vaucheria, Peronosporæ, Cystopus, Fucus; (4) The Red Seaweeds and their allies (Carposporeæ), Podosphæra, Eurotium, Parmelia, Puccinia, Agaricus; (5) The Mosses and their allies (Bryophyta), Marchantia, Mnium; (6) The Ferns and their allies (Pteridophyta), fern prothallia, and fruiting, Pteris, Polypodium, Selaginella. III. *The Structure and Physiology of Phanerogams.*—The structure of Gymnosperms; the sexual reproduction of Monocotyledons; the sexual reproduction of Dicotyledons.

The Study of Algæ in the United States.—About nine years ago Dr. H. C. Wood, of Philadelphia, published his now well known "Contribution to the history of the fresh water Algæ of North America," which made it possible for the student to begin the systematic study of our fresh water species. Within

[1] Edited by Prof. C. E. Bessey, Ames, Iowa.

two or three years, Dr. Allen and Dr. Halsted have pretty well worked up our Characeæ (which we must regard as Algæ, in the face of the fact that algologists regard them as falling within the jurisdiction of the bryologists). It is a pleasure now to notice the important contribution made by Dr. Farlow, whose "Marine Algæ of New England and the adjacent coast," appeared early in July. It is reprinted from the belated "Report of the U. S. Fish Commission for 1879," and consists of 200 pages of text, accompanied by fifteen plates. The author has been connected with the Fish Commission for many years, and has thus had most excellent opportunities for studying the Algæ of our North Atlantic coast. How well he has improved those advantages even a casual examination of this valuable book will show. It is designed to be used as a hand-book for the classification of the species (excepting the Diatoms) of our coast from New Jersey northward, and it is not too much to say that the author has been entirely successful in making a book which every sea-coast visitor with botanical inclinations will find indispensable.

In his introduction Dr. Farlow discusses some peculiarities in the distribution of our Algæ which are interesting, as follows: "It will be seen that Cape Cod is the dividing line between a marked northern and a southern flora. In fact, the difference between the floræ of Massachusetts bay and Buzzard's bay, which are only a few miles apart, is greater than the difference between those of Massachusetts bay and the Bay of Fundy, or between Nantucket and Norfolk. This difference in the flora corresponds precisely with what is known of the fauna. That Cape Cod formed a dividing line was known to Harvey, and subsequent observation has only shown, on the one hand, that the flora north of Cape Cod is more decidedly Arctic than he supposed, and that, on the other hand, south of the cape it is more decidedly that of warm seas. The general fact of the distinctness of the two floræ is not weakened by the knowledge that we now possess, owing to the investigations of the Fish Commission, of the existence in a few sheltered localities north of Cape Cod, of some of the characteristic species of Long Island sound, and in a few exposed spots south of the cape, of northern species." Further on, in speaking of the characteristic species between Boston and Eastport, he says: "In studying these we must turn not to the works on the Algæ of France or Great Britain, but rather to those on Scandinavian Algæ. It is especially instructive to examine the Algæ Scandinavicæ, by Professor Areschoug, in connection with our own forms. The resemblance is at once striking." South of Cape Cod the Florideæ are characteristic, and here West Indian and even Adriatic forms appear.

The general classification is as given below, beginning as is happily becoming the custom, with the simpler forms and passing to the higher. Order I. *Cryptophyceæ*, nearly equivalent to Cyanophyceæ or Phycochromaceæ, and containing the sub-orders Chroococcaceæ and Nostochineæ. Order II. *Zoosporeæ*, with the sub-orders Chlorosporeæ, Bryopsideæ, Botrydieæ, Phæosporeæ. Order III. *Oosporeæ*, with sub-orders Vaucherieæ and Fucaceæ. Order IV. *Florideæ*, including sub-orders Porphyreæ, Squamarieæ, Nemalieæ, Spermothamnieæ, Ceramieæ, Spyridieæ, Cryptonemieæ, Dumontieæ, Gigartineæ, Rhodymenieæ, Spongiocarpeæ, Gelidieæ, Hypneæ, Solierieæ, Sphærococcoideæ, Rhodomeleæ, Corallineæ.

THE LITERATURE OF BOTANY.—Mr. B. D. Jackson's "Guide to the Literature of Botany" (Longmans, Green & Co., and Dulau & Co., London), will prove indispensable to the working botanist. It is not simply a list of all the botanical publications, but a selected and classified list, so that when one consults it he is not obliged to hunt through a great mass of less important matter. The selections have been quite well made, and as the book contains 6000 titles not found in Pritzel's "Thesaurus" (not 6000 *more*, as we thought from the prospectus and so noted in the June "Notes") it should at once find a place upon the shelves of every botanist's library. The general appearance of the book, which contains over six hundred small quarto pages, is good, and the typographical errors are, considering the nature of the work, remarkably rare.

A HINT TO MICROSCOPISTS.—The editor of this department, since the publication of his "Botany for High Schools and Colleges," has been in receipt of numerous inquiries from teachers and others, who, for want of time or the necessary training, are unable to prepare illustrative specimens for study or demonstration. It is, of course, true that it is far better to study fresh material, and the teacher who can direct his pupils how to collect and prepare their own specimens is doing the best work. But the fact remains that for a very great number it is impossible for them, with their thousand and one other duties, to take upon themselves the additional labor required to supply, at the proper time, the proper illustrative specimens. To meet the wants of such cases, and they are numerous, why cannot some of our microscopists put up sets of mounted slides, designed to show the more important structures, in a well selected list of illustrative plants. A set of twenty-four specimens, somewhat as follows, would be useful. *Protophyta*—(1) Protococcus, (2) yeast plant; *Zygosporeæ*—(3) Hydrodictyon, (4) Diatoms, (5) Spirogyra, (6) Mucor; *Oosporeæ*—(7) Volvox, (8) Vaucheria, (9) Peronospora, (10) Fucus; *Carposporeæ*—(11) a fruiting Red Alga, as Nemalion, (12) Erysiphe, (13) a lichen, as Usnea, (14) *Puccinia graminis* in all its stages, (15) sections of mushroom, (16) Chara or Nitella; *Bryophyta*—(17) antheridia and archegonia of a moss, (18) spores and capsule (in section) of a moss; *Pteridophyta*—(19) prothallium of a fern, (20) spores and sporangia of a fern, (21) macrospores and microspores of Selaginella; *Phanerogamia*—(22) pollen, (23) young pistil (sections) and ovules, (24) seeds (sections) with embryo *in situ*. The specimens should, in some cases, be of considerable size, and in every case, where possible, the sexual reproductive organs should be clearly shown. The list might profitably be much enlarged, while a valuable half set costing much less might be made by selecting from the full set, say by taking Nos. 1, 2, 5, 8, 12, 16, 17, 19, 20, 22, 23, 24.

Errata.—Through some delinquency in the U. S. mails, the editor of this department failed to receive the proof of the August number in time to correct some typographical errors. On p. 653, third line, Myxomycetes appears spelled incorrectly; the second word in the fourth line should be "fine"; Professor Tuckerman's name appears without an r, for which we beg his pardon; further down Dr. Farlow is said to have described "a carpinus which grew in a jar of water"! which no doubt made many botanists stare with amazement. What we wrote was "coprinus," a very different thing indeed! The additions to the N. A. Flora made by Dr. Engelmann, were "some additions," not "Iowa additions."

A correction should also be made in Dr. Schimper's paper, p. 558, fifth line, where "less watery" should be "more watery."

Botanical Notes.—In the April number of the *Journal of the Linnean Society*, Francis Darwin publishes an interesting paper on "The theory of the growth of Cuttings." The other articles of this number are on the Vegetation of Chumba State and British Lahoul; Australian Fungi; New plants from the Cape of Good Hope; An Erythræa new to England; Revision of the genus Vibrissea. The June number of the same journal contains an article on the power possessed by leaves of placing themselves at right angles to the light, by Francis Darwin. It is illustrated by seventeen woodcuts, five of which are explanatory of the klinostat, or apparatus which he used in making his observations. This portion of the article is of especial value to those who wish to repeat or extend Mr. Darwin's observations. Papers on the coffee leaf disease, proliferous *Verbascum nigrum*, stipules in *Ilex Aquifolium*, and Right and Left hand contortions, complete the number. In the last mentioned article the writer, Mr. Clarke, uses some pretty vigorous English in discussing the vexed question of the direction of the spiral; for example: "I suppose myself to have shown, (1) That Linnæus's original definition of right hand twist is exceedingly good, and contains no surplusage; (2) That in observing contortions it makes no difference whether you imagine yourself within or without the spire, so long as you do not turn yourself round, or stand upon your head." All will agree with him "that it does not much matter which way it is settled, but that it is of the greatest importance to all botanic describers that it should be settled, definitely and finally, one way *or* the other.——C. B. Clarke's paper in the July *Journal of Botany*, "Notes on Commelinaceæ," is very interesting as containing a summary of the order as it is to appear in the forthcoming volume of De Candolle's "Monographies." In the same journal, J. G. Baker catalogues the ferns collected by Kalbreyer in New Granada, and describes twenty-one new species.——J. B. Ellis, in the July *Torrey Bulletin*, describes eleven new species of Fungi from Utah, collected by M. E. Jones.——A notice of the Muhlenberg Herbarium, now in possession of the American Philosophical Society in Philadelphia, and a continuation of the List of the State and local floras of the United States, occur in the same number of the *Bulletin*.——Dr. Rothrock's paper on "Home and foreign methods of teaching Botany," in the July *Botanical Gazette*, is one which should be read by every teacher of botany in the country. It contains a strong plea for *the study of plants rather than books*. In the same number Dr. Engelmann describes several new species of plants, among them a suffrutescent Portulaca. C. H. Peck also describes some new Fungi from Utah. ——C. F. Wheeler and E. F. Smith, of Hubbardston, Mich., have just issued a "Catalogue of the Phænogamous and vascular Cryptogamous plants of Michigan." It contains entries of 1634 species, of which 1559 are flowering plants. Valuable notes are appended to many of the species, and a good map of the State is added. The authors offer a limited number of copies of this valuable catalogue for sale at fifty cents each.——Dr. E. L. Sturtevant, well known for his many important contributions to economic botany, has just added another, "The growing of Indian Corn," a pamphlet of fifty pages, extracted from the Twenty-eight report of the Massachusetts State Board of Agriculture.

ZOÖLOGY.

A Shower of Cyclops quadricornis.—I have just received (June 12) from C. L. Garretson, of Salem, Henry county, Iowa, a small vial containing about half a teaspoonful of water, accompanied by a note in which he says, "On the night of June 8, 1881, there was a heavy rain-fall, and on the morning of the 9th the ground was covered, in places, with something that looked like blood. I found that they were living creatures, and with a spoon took up a pint of the muddy water containing them."

Upon examining the sample received, I found it to be swarming with *Cyclops quadricornis*, or what I take to be that species. The only thing peculiar about them, is, that the body is full of bright red corpuscles, which accounts for their imparting a red appearance to the water containing them. A specimen of the same creature taken from a jar of water that has been standing in my office for several weeks, contains a few of these corpuscles, but not a hundredth part as many as are in the bodies of the rain-water specimens. While it might not be considered remarkable that a few of these animals should be found in pools of rain-water, I am puzzled to understand how they came here in such immense numbers, unless we suppose that they were distributed through the whole body of rain that fell, and were afterwards concentrated by the draining away of the surplus water. There were not less than five hundred in the sample of water sent me, of which about one-third were alive when received, after having been tightly corked for several days.—*F. E. L. Beal.*

Mussel and Insect Climbers.—In *Psyche*, Vol. iii, No. 80, just issued, Victor Tousey Chambers states an interesting fact regarding the minute larva of the Tineid, *Aspidisca saliciella* Cham. He says the method by which it climbs a tree or weed, "is one of the most surprising in the insect world." The larva is footless, nor does it gain a foothold by the exudation of any glutinous, or other secretion; yet encumbered by its case, it climbs trees, fences, &c. "The larvæ travel solely by their silk. Successive taps are given with the end of the spinneret to the surface on which the larva lies, thus a minute byssus is formed, to which the spinneret adheres, the body is then contracted, so that the under surface of the case is attached. The head and segments are again extended, and another byssus is made, and the body contracting, the case is again brought up and attached. Its attachment is only by a few silken threads, each of which is less than 0.0002^{mm} in diameter, and the fresh silk readily stretches or breaks. This is the sole mode of progress of the larva."

I have thought it would add to the interest of the above, to ask the reader to compare it with our account of the mode of perpendicular climbing as practiced by the black mussel, *Mytilus edulis*, in American Naturalist, Vol. iv, 1871, p. 331. As there described, the climbing of this mollusk is almost identical with that of the larval Tineids described by Chambers. The operations of the mussel being on a larger scale were easily observed, hence each step in the process is given. The figure of the mussel, is, by an unfortunate misunderstanding of the printer, placed wrong. The umbo, or pointed end of the shell, should be down, and the nib, or open end, should be up. Then against the three sets of byssus let the imagination put the perpendicular side of a rock, and we have the animal in climbing position. My object in not drawing the rock was simply to save expense in engraving.—*Samuel Lockwood, Freehold, N. J., May, 1881.*

A Woodchuck Climbs a Tree.—About two years ago a young man who was living with me, came in one day saying that he had just seen a small animal, possibly a raccoon, ascending a tree in the woods some sixty rods away. Taking my shot-gun, I went to the place, where I soon saw the creature in the top of a black oak tree, almost forty feet from the ground. The animal seemed very cunning, and managed for some time to keep on the opposite sides of some of the larger limbs, but I finally got a shot at him. He came to the ground with a bounce, when I found it was a woodchuck. It was but slightly wounded in one of the fore legs, and I captured it and took it home. I put it in a hollow tree near my residence, and it remained there a couple of weeks, freely eating the corn which I regularly fed it. But one night it emigrated, and I saw it no more. These animals are not plentiful in this region, indeed in a residence here of twenty-four years, I have only seen one other specimen, though occasionally hearing them mentioned. Until this incident, I did not know that they ever ascended such tall trees.—*Charles Aldrich, Webster City, Iowa, June 9, 1881.*

CARPHOPHIOPS HELENÆ IN INDIANA.—This species of serpent was originally described from specimens obtained at Monticello, Miss., and in Southern Illinois. I have a specimen that was captured by Mr. Charles Jameson, of Indianapolis, in Brown county, Indiana. The locality is about forty miles south of Indianapolis. —*O. P. Hay.*

EUTÆNIA RADIX IN INDIANA.—In the Museum of Butler University there is a good and well characterized specimen of *Eutænia radix*, that I have every reason to believe was found at Irvington, near Indianapolis. The species is found at Bloomington, Illinois, and is included, by Dr. W. H. Smith, in his "Catalogue of the Reptiles and Amphibians of Michigan," as occurring in that State.—*O. P. Hay, Butler University, June 15.*

HABITS OF THE YELLOW-BELLIED WOODPECKER.—I found, at Buckfield, Maine, early in July, a yellow-bellied woodpecker's nest, and with it collected a large section of a white birch tree that shows their marks in vertical instead of horizontal rows, and is a proof that they eat the sap if not also the bark. The humming-birds were very thick around the tree, sucking the sap where it was running from the holes; there were also butterflies and moths around it. The nest was very peculiar, being placed on the north side of a tall poplar.—*H. C. Bumpus.*

PROBABLE CAUSE OF THE LONGEVITY OF TURTLES.—So far as we are aware, no attempt has been made to explain the unusual longevity of turtles, whose lives, as is well known, span over a century. There appears to be no longer-lived animals than these beings of slow gait and slow manner of life. The following facts may throw light on the cause of their great age. In the first place they are protected by their solid shell from the attacks of snakes, fishes and birds; young turtles, we are informed by Professor J. W. P. Jenks, are sometimes carried off by herons, but in adult life they are probably rarely eaten by other animals. Has any one ever found any empty turtle shells? As some turtles lay but two or three eggs a year, nature seems to have counted upon an immunity from the ordinary evils of childhood in these animals. It is probable that the larger proportion of, indeed most, young turtles when hatched survive, and when two or three years old, are fitted to resist successfully ordinary fish and avian enemies. They are not exposed to vicissitudes of weather; the fact that the period of egg-laying (in New England from June 10–20) is so constant, and varies so little at different seasons, shows that they are hardy and tough. Finally, the persistence of the type of gigantic tortoises on the Galapagos islands, indicate the wonderful vitality of this type of life in resisting prolonged climatic and geological changes.—*A. S. Packard, Jr.*

The Trichina and other Animal Parasites.—Renewed attention has been drawn to the Trichina. According to the *Penn Monthly*, Dr. Leidy has recently stated that this parasite was first discovered by an English surgeon in 1833, but its presence in pork was first detected by Dr. Leidy himself in 1840. He reminds the public for their comfort: 1st, that all food animals are liable to have parasites, and that the tape-worm is sometimes conveyed in rare beef; 2d, that only one hog in about ten thousand is infected with trichinæ; and, 3d, that thorough cooking will kill all such parasites, while none of them are poisonous after a good cooking. He believes that the Mosaic prohibition of pork was due to the danger of trichinosis, in a country where fuel was scanty, and, therefore, their food seldom well cooked. He thinks that millions may have died of trichinosis in the centuries before the true source of the danger was discovered, and that many of the deaths which occurred in the army during the Civil War were due to the frequent use of raw and badly cooked pork, although ascribed to typhoid, rheumatic or malarial fevers.

For a general account of the trichina and allied parasites we would refer the reader to an excellent book[1] published a few years ago by Professor Van Beneden, a Belgian naturalist, who, by the way, was the first to discover the history of the transformations of the tape-worm. Van Beneden divides animal parasites into several categories. The first are free messmates, which only live as boarders or *commensals* in the bodies or in intimate relations with other animals, such as hermit crabs, the pilot fish, Remora, etc.; second, the fixed messmates, as barnacles, etc.; third, mutualists, such as a certain louse of the dog, which harbors a larval tænia; and lastly parasites, which include leeches, lice, fleas, ticks, ichneumon flies, and finally the genuine parasites, such as the tape-worm and trichina, which migrate from one host to another in order to complete their metamorphoses. It is the cheapest, most reliable and best illustrated work of the kind we have seen.

[1] Animal Parasites and Messmates. By Professor P. J. Van Beneden. With 83 illustrations. The International Scientific Series. New York: D. Appleton & Co. 1876. 12mo, pp. 274.

The Tail in the Human Embryo.—This is a subject of considerable interest in view of the occasional statements regarding tailed races of men in the interior of Africa, and of the supposition that the human embryo has a tail homologous with that of the monkeys, and that, therefore, in this respect, man passes through a monkey-stage, as insisted upon by Haeckel, who remarks in his "History of Creation," Vol. I, p. 308, "Now, man in the first months of development possesses a real tail as well as his nearest kindred, the tailless apes (orang-outang, chimpanzee, gorilla), and vertebrate animals in general. But, whereas, in most of them—for example the dog, it always grows longer, in man and in tailless mammals, at a certain period of development, it degenerates and finally completely disappears. However, even in fully developed men, the remnant of the tail is seen in the three, four or five tail vertebræ (vertebræ coccygae) as an aborted or rudimentary organ, which forms the hinder or lower end of the vertebral column." Now this notion is rudely disputed by Professor His, who contradicts in a paper on this question (abstracted in the Journal of the Royal Microscopical Society) the assertion that at a certain stage in its development the human embryo has a true tail, which is afterwards absorbed. As to the definition of a tail, Professor His considers that the caudiform or tail-like prolongation is a true tail when, extending beyond the cloaca, it contains a number, greater or less, of supernumerary vertebræ. Without this condition there is merely a caudiform appendage. His knows of no well-authenticated case of supernumerary vertebræ in the human embryo, and pathological observation he believes to coincide with embryological knowledge in justifying the assertion that in man the normal number of thirty-four vertebræ is never exceeded.

Prof. His' paper appeared in 1880; the same year, however, Dr. Leo Gerlach published in Gegenbaur's Morphologisches Jahrbuch (Band VI, Heft. I.) a paper on a case of tail-formation in a human embryo. He refers to a case of the occurrence of a tail in an abnormal embryo described in 1840 by Dr. Fleischman. On holding the fœtus up to the light there appeared, in the first third of the eight-lines-long tail, five dark points through the thin skin, which he regarded as vertebræ, the continuation of a spine. The end of this tail seemed to be skinny, and was very delicate and transparent. This embryo forms the subject of Gerlach's exhaustive anatomical account before us. The embryo is 10.8 centimeters (four inches) long and was in the early part of the fourth month of embryonic life. The free portion of the tail is 12^{mm} in length; it is long and slender, being in length equal to that of the foot of the embryo. In this tail a well-marked notochord is present. The organ, therefore, should be regarded as the homologue of a genuine tail, and Gerlach considers it as a case of atavism, and that it represents an earlier phylogenetic condition. He thinks, for reasons which he assigns, that at an earlier embryonic date there were a longer notochord, a longer medullary tube and a greater number of primitive or proto-vertebræ. In an embryo a few weeks older, on the other hand, the notochord would entirely disappear. Haeckel's view, therefore, is, so far as one abnormal example is concerned, apparently sustained against that of His.

New Type of Parasitic Crustacean.—A new parasitic Cirriped (*Laura*) has been discovered by Lacaze-Duthiers, according to the Journal of the Royal Microscopical Society, living as an Antipatharian coral (*Gerardia*). Externally it is kidney-shaped, and its body, composed of twelve segments with six pairs of limbs, is imbedded in the soft parts of the coral; it is a little over a centimeter long, with a carapace formed of two scales or valves united along the median line, and is from two to four times as long as the body. The carapace is hard externally with a soft internal layer; between these there is lodged the liver and one of the genital glands, together with a very rich vascular plexus. The external covering is riddled by a large number of small ducts, the outer orifices of which are covered by a membrane, which is surrounded by delicate filaments; these are of a cartilaginous consistency, and have a central duct. A study of the circulatory organs shows that the tissues on the inner face of the carapace are supplied with a rich capillary plexus, which surrounds all the organs, and gives rise to nutrient lacunæ. These communicate with the internal orifices of the canals, so that we may say that Laura gives off thousands of radicles, which force their way into the tissues of the coral. The peculiar arrangement of the digestive system confirms this view. As regards this, the liver is of great size, the digestive tube is a closed sac, with no mouth or vent, and is always full of a yellow, pultaceous matter, which appears to be similar to the hepatic secretion.

The food is absorbed by the walls of the carapace, the absorbed products are purified by the biliary secretion, which here at any rate appears to have a depuratory function. The ovary and testes occur in the same individual. The young are born in the Nauplius condition.

Cilia and possible Nervous System of Infusoria.—In a recent essay on cilia, Prof. J. W. Engelmann, referring to the Infusoria, says that notwithstanding the very high specialization of these "unicellular" organisms, he could not detect among them intracellular fibers subtending the cilia, such as those which occur in the ciliated epithelium of Lamellibranchs. Of this kind are not the muscular striæ of Stentor, alleged by Simroth to be in connection with the cilia beneath which they course. This connection Engelmann could not confirm. Certain it is that the ciliary movements of Stentor are independent of the general contractions of the body.

Do the Infusoria possess an approximation to the nervous system of the higher animals? It was thought by the late Professor H. J. Clark (see his "Mind in Nature") that the higher Infusoria had a nervous system or something analogous to it. Engelmann now says (Journal of the Royal Microscopical Society for April) that the Infusorian, *Stylonychia mytilus*, has unquestionably a system of ventral fibers trending from near the middle line, beneath the ectoplasm, to the two conspicuous series of large admarginal cilia, which aid so powerfully the motions of this huge animalcule. But these fibers are not like the fibers of ordinary ciliated cells, nor are the lashes which they supply cilia, properly so called. The lashes are complex appendages, remote from one another, moving independently under the control of their possessor. Each has its own fiber, which is pale, soft, homogeneous, and not more than 0.2μ across. The fibers are parallel and so delicate that they can only be seen for a short time in specimens starved during some hours in filtered water, and then killed in osmic acid. Are not these fibers truly nerves? Why, asks Engelmann, should not the higher Infusoria possess a nervous system? May not more exact researches soon decide this question in the affirmative? Has not *Panophrys flava* eyes? If not so what is the function of the watch glass-shaped organ with its pigment-spot?

New Genera of Cuttle Fishes.—In the Transactions of the Danish Academy of Science, Professor Steenstrup describes two interesting genera allied to Sepia, under the name of *Sepiadarium kochii* and *Idiosepius pygmæus*. They inhabit the Indian ocean. One of the arms of the 4th ventral pair in the males is adapted to serve as a fertilizing organ (a hectocotyle), the female receiving the spermatophores on the internal face of the buccal membrane. The distinguished author closes his memoir with a comparative view of all the known genera of Myopsidan cephalopods.

Note regarding change of color in Diaptomus sanguineus.—I visited the Glendale pond July 27th, and found thick swarms of this Copepod. Only a few had egg-sacs, and no male was found; while the females were not red, but bluish. The antennæ had remained red, also the furca, but the postabdomen was yellow, and the body and legs bluish.—*C. F. Gissler.*

New Discoveries concerning Deep-sea Crustacea of the Gulf of Mexico.—Additional information of a good deal of interest has since our last note on this subject been published by A. Milne Edwards. From an abstract in the *Journal* of the Royal Microscopical Society, it appears that forty new generic types were discovered, while certain groups which had been supposed to be absent from the American seas are very richly represented at these great depths. Crabs proper disappear below 500 meters from the surface: at 800 meters, however, there was found Bathyplax, which takes the place of Gonoplax of the French coast, but it is blind. Representatives of Willemoesia were found at 3500 meters, and these too were blind.

The infinite variety of the forms is, however, the most astonishing point, transitional types abound, and groups hitherto regarded as very distinct are now linked by intermediate forms. As examples, the author cites the Paguridæ, generally placed among the Anomura, and which have as yet had no link uniting them to the Macrura; now there is *Pylocheles agassizii*, in which the abdomen is not soft and asymmetrical, but is formed of solid regular rings, and terminated by swimmerets. This creature lives in holes, which it closes by means of its claws. *Mixtopagurus* has the abdomen more developed on the right than on the left side, and divided into seven segments, of which the last two are alone large and hard. There are some curious adaptive modifications: *Eupagurus discoidalis*, which lives in the tubular shells of Dentalium, has one of its claws spherical. Xylopagurus lives in holes in wood, and has its abdomen converted into an operculum for covering one of the two holes of its retreat. Similar connecting links were found between the Dromidæ and the Homolidæ, and on the whole the author concludes that submarine explorations will aid palæontological investigations in gradually filling up the lacunæ now existing in zoölogical systems.

The Musk Sheep.—In Dr. Bessel's account of the North Pole expedition published in German, and noticed in *Nature*, valuable accounts of this animal are given. None of those killed by the members of the expedition had a very marked musk smell. The author is uncertain whether this peculiarity is to be attributed to the very high latitude in which they were obtained, or to their having been killed out of the breeding season. No difficulty was found in distinguishing the tracks of these animals from those of reindeer, although some former observers have not found this easy. In all the herds there are from ten to twenty cows to one bull. Their whine is somewhat like the snorting of the walrus, and never resembles in the least the cry of the goat or the sheep. When danger approaches they never give signal with their voice, but only by stamping or striking their neighbor with their horns. They have dire combats with bears sometimes, and often come off victors.

Zoological Notes.—The organization of an Echiurus-like Sipunculoid worm (*Thalassema mœbii* Greef), has been studied by Greef, who regards the anal pouches of the Echiuri as branchiæ comparable to the aquiferous lungs of Holothurians.——The organs of taste in the Heteropod mollusks are considered by Professor Todaro to have the same structure as in mammals. They are arranged in two or three rows on each side of the mouth cavity, or externally on the proboscis of Pterotrachea. They are little papillæ with internal sense-cells situated next to the termination of the nervous fibrilla, while externally they each carry a long sensitive hair, and the different sensitive hairs of these cells traverse the canal of the cuticular layer, and arrive at the level of the gustatory pore.——In the Annals of the New York Academy of Sciences, Mr. R. E. C. Stearns publishes a paper on the existence of a colony of *Helix aspersa* in California, which was planted twenty-three years ago at San José. He also remarks on the geographical distribution of certain West American land-snails, and corrects previous errors concerning them.——In *Nature*, Mr. W. A. Herdman collects the evidence brought forward by Charles Julien, which shows strong ground for the belief that the little understood "neural gland" in the Ascidians, represents the glandular portion of the *hypophysis cerebri*, or pituitary body of vertebrates.——At a recent meeting of the Royal Society of London, Professor W. K. Parker, in a paper on the structure and development of the skull in sturgeons, remarks in closing, that the sturgeons as a group cannot be said to lie directly between any one family of the Selachians and any one family of the bony Ganoids, yet, on the whole, that is their position; the bony Ganoids, on the whole, approach the Teleostei, especially such forms as Lepidosteus and Amia, which have lost their "spiracle," and in other points are less than typical, as Ganoids. Larval sturgeons are, in appearance, miniature sharks; for a few weeks they have a similar mouth, and their lips and throat are beset with true teeth that are molted before calcification has fairly set in. Their first gills are very long and exposed, but not nearly so long, or for such a time uncovered, as in the embryo of sharks and skates.

A CORRECTION.—On pp. 585 and 586 of the July NATURALIST, a serious inadvertency occurs. In the list of strictly fresh-water shells is mentioned *Helicina occulta* (by typographical error printed *oculata*). Though Helicina is not a pulmonate, the species here indicated is strictly terrestrial in its habit. The reader will therefore refer it to the preceding list of land shells, where the intention was to have placed it.—*R. Ellsworth Call.*

ENTOMOLOGY.[1]

THE CULTIVATION OF PYRETHRUM AND MANUFACTURE OF THE POWDER.[2]—*The use of Pyrethrum as an Insecticide.*—Up to a comparatively recent period the powder was applied to the destruction of those insects only which are troublesome in dwellings, and Mr. C. Willemot seems to have been the first in the year 1857 (?) to point out its value against insects injurious to agriculture and horticulture. He goes, however, too far in his praise of it, and some of his statements as to its efficacy are evidently not based upon actual experiment. Among others he proposes the following remedy: "In order to prevent the ravages of the weevil on wheat fields, the powder

[1] This department is edited by Professor C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

[2] Continued from July number.

is mixed with the grain to be sown, in proportion of about ten ounces to about three bushels, which will save a year's crop." This is simply ridiculous, as every one who is familiar with the properties of Pyrethrum will understand. We have during the past three years largely experimented with it on many species of injurious insects, and fully appreciate its value as a general insecticide, which value has been greatly enhanced by the discovery that it can be most economically used in liquid solution; but we are far from considering it a universal remedy for all insects. No such universal remedy exists, and Pyrethrum has its disadvantages as has any other insecticide now in use. The following are its more serious disadvantages: 1. The action of the powder, in whatever form it may be applied, is not a permanent one in the open air. If, *e. g.*, it is applied to a plant, it immediately affects the insects on that plant with which it comes in contact, but it will prove perfectly harmless to all insects which come on to the plant half an hour (or even less) after the application; 2. The powder acts in the open air—unless, perhaps, applied in very large quantities—only upon actual contact with the insect: if *e. g.*, it is applied to the upper side of a cotton leaf the worms that may be on the underside are not affected by it; 3. It has no effect on insect eggs nor on pupæ that are in any way protected or hardened.

These disadvantages render Pyrethrum in some respects inferior to arsenical poisons, but, on the other hand, it has the one overshadowing advantage that it is perfectly harmless to plants or to higher animals; and if the cultivation of the plant in this country should prove a success, and the price of the powder become low enough, the above mentioned disadvantages can be overcome, to a certain degree, by copious and repeated applications.

In a closed room the effect of Pyrethrum on insects is by far more powerful than outdoors. Different species of insects are differently affected by the powder. Some resist its action most effectually, *e. g.*, very hairy caterpillars and especially spiders of all kinds; while others, especially all Hymenoptera, succumb most readily. In no case are the insects killed instantaneously by Pyrethrum. They are rendered perfectly helpless a few minutes after application, but do not die till some time afterward, the period varying from several hours to two or even three days, according to the species. Many insects that have been treated with Pyrethrum show signs of intense pain, while in others the outward symptoms are much less marked. Differences in temperature and other meteorological changes do not appear to have any influence on the effect of Pyrethrum.

Modes of Application.—Pyrethrum can be applied, 1. In dry powder; 2. As a fume; 3. As an alcoholic extract diluted; 4. By simple solution of the powder in water; 5. As a tea or decoction.

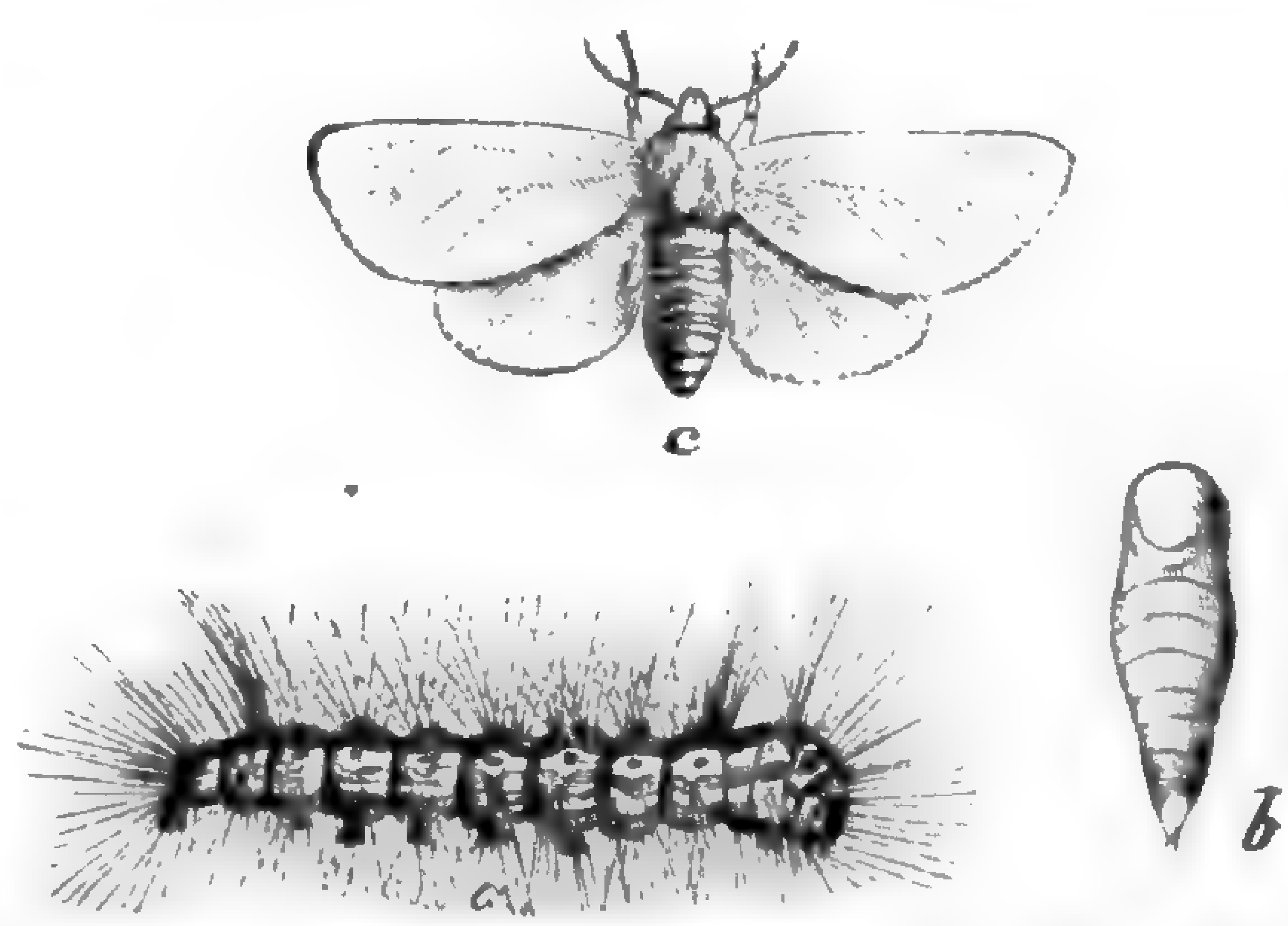
The following recommendations are based on repeated experiments in the field:

1. *Applications of Pyrethrum as dry powder.*—This method is familiar to most housekeepers, the powder being used by means of a small pair of bellows. It is then generally used without diluent, but if it is unadulterated and fresh (which cannot be said, in many instances, of the powder sold at retail by our druggists) it may be considerably diluted with other pulverized material without losing its deadly effect, the use of the powder thus becoming much cheaper. Of the materials which can be used as diluents, common flour seems to be the best, but finely sifted wood-ashes, saw-dust from hard wood, etc.; in short, any light and finely pulverized material which mixes well with the Pyrethrum powder, will answer the purpose. If the mixture is applied immediately after preparation, it is always less efficacious than when left in a perfectly tight vessel for about 24 hours, or longer, before use. This has been proven so far only with the mixture of Pyrethrum with flour, but holds doubtless true also for other diluents. Mr. E. A. Schwarz experimented largely under our direction with the mixture of Pyrethrum and flour for the Cotton Worm, and he found that one part of the powder to 11 parts of flour is sufficient to kill the worms (only a portion of the full-grown worms recovering from the effects of the powder), if the mixture is applied immediately after preparation; but if kept in a tight glass jar for about two days, one part of the powder to 22 parts of flour is sufficient to kill all average-sized worms with which the mixture comes in contact. For very young cotton worms a mixture of one part of Pyrethrum to 30 parts of flour, and applied one day after preparation, proved most effective, hardly any of the worms recovering.

An ordinary powder bellows will answer for insects infesting dwellings or for plants kept in pots in rooms, or single plants in the garden, but it hardly answers on a large scale out-doors, because it works too slowly, the amount of powder discharged cannot be regulated, and there is difficulty in covering all parts of a large plant. Another method of applying the dry powder is to sieve it on to the plants by means of sieves, and this method is no doubt excellent for insects that live on the upper side of the leaves. For large, more shrub-like plants with many branches and for insects that hide on the underside of the leaves this method will be found less serviceable. A very satisfactory way of applying the powder on large plants, in the absence of any suitable machine or contrivance, is to throw it with the hand after the manner of seed-sowing. This method is more economical and rapid than those mentioned above and it has, moreover, the advantage that, if the plants are high enough, the powder can be applied to the underside of the leaves. *(To be continued.)*

THE CATERPILLAR NUISANCE IN CITIES: HOW TO SUPPRESS IT.—In the public interest you have already drawn attention to the numerous caterpillar nests that are now disfiguring the shade trees in most parts of the city. These trees are a marked and beautiful feature of Washington, and our Park Commissioners cannot be too greatly praised for their endeavors to properly care for them and protect them from injury. In this good work they should be aided by all public spirited citizens. I have thought, therefore, that a few suggestions in reference to this caterpillar nuisance would be timely and might do some good.

This Web-worm, known in entomological works as the fall-web-worm (*Hyphantria textor*), is one of the most wide-spread and injurious insects in the country, feeding, as it does, on all sorts of trees, and occurring everywhere east of the Rocky mountains. The parent is a white moth, more or less spotted with black, which issues in spring from the cocoon in which the chrysalis has hibernated, generally near, or just below, the surface of the ground, but also in any other sheltered situation. The pale yellow eggs are laid, to the number of 300 and upward, during the last days of May and the earlier part of June, in this latitude, in one uniform batch, slighly interspersed with white hairs from the body of the female. They are not easily noticed, and it is useless to attempt their destruction in a general way. Immediately upon hatching, the young worms feed together on the parenchyma of the leaf, leaving nothing but the epidermis. As they grow they spread from leaf to leaf, enclosing whole branches with their web, and few attempts are made to destroy them until they have rendered themselves conspicuous, and are nearly full-grown as at the present time. At this stage there is no more available way of destroying them than by pruning off the infested twigs and branches, care being taken to subsequently destroy the worms. A wad of cotton, or other material, attached to the end of a long pole, saturated with kerosene or coal tar and ignited will also do good service in burning them. But on all the smaller trees of the city that can be readily reached with a hand pump, there is a much simpler remedy which might be uniformly employed by the Commissioners at trivial expense. With a little practice the first affected leaf or leaves can be detected during the first days of June before the trees shows any disfigurement. If at such time the parts of the tree where the young caterpillars have been noticed be



Hyphantria textor; *a*, larva; *b*, chrysalis *c*, moth (after Riley).

sprinkled with water in which London Purple has been mixed in proportion of about 1 pound of the purple to about 100 gallons of water, the young worms will all be destroyed thereby and no further disfigurement of the tree ensue from them. A second application about the middle of June to the more limited number of worms that hatch from eggs laid after the first application, may also be desirable. The purple can be got at wholesale from Hemingway & Co., New York, at from 6 to 10 cents a pound, and a few dollars' worth would answer for the trees of the whole city. It would pay the Park Commission to have a special tank built and mounted on wheels for this purpose, with a force pump that might be worked with two men, while a third handles the atomizing nozzle through which the poisoned spray should be applied. One of the simplest and most satisfactory nozzles of this kind is made by two converging holes so that the two jets of water break each other as they issue. Important improvements in the mode of atomizing will be published in the next report of the Entomological Commission; but it is not necessary to illustrate them in this connection. A tank for poisoned water, such as I have indicated, would not only prove valuable in protecting the trees from this particular caterpillar, but from most injurious insects that attack them, as, *e. g.*, the imported Elm-leaf beetle, which is so bad on the elms in the grounds of the Department of Agriculture and elsewhere. No better investment can be made by the authorities.

For private gardens and parkings I would recommend one of the ordinary force-pumps, and the Nelson aquæpult will be found particularly satisfactory.—*C. V. Riley, in Washington Evening Star.*

BLEPHAROCERIDÆ.—Mr. J. Q. Adams, of Watertown, N. Y., writes under date of June 28th, that he recently found what, from our description in a late number of the NATURALIST, he recognized as Belpharocerid pupæ. They were in a very cold stream of water in the country back of Watertown, where the water ran over smooth slate rock with numerous falls. They soon died and became foul, however, when transferred to still water. We subsequently succeeded in obtaining specimens in the pupa and imago state and they proved to be genuine Blepharocerids, the species not yet determined.

REMARKABLE CASE OF RETARDED DEVELOPMENT.—Mr. J. D. Graham, of the Kansas State Agricultural College at Manhattan, has sent us for identification the eggs and newly hatched young of a locust which, on examination, proved to be of *Caloptenus spretus*. The facts connected with these eggs and their hatching are so remarkable, that few persons would be willing to credit them were the circumstances not given with care and by a competent observer. He writes: "These eggs were buried in the fall of 1876, and a sidewalk was laid immediately above them. This walk has not been moved since that time, until the eggs were found. The earth which covered the eggs was principally clay, old mortar and bits of stone, though there was some black earth immediately surrounding the eggs."

The eggs were found, it seems, while men were cleaning away an accumulation of spalls, mortar and clay, and the sidewalk above referred to, in the rear of the laboratory. We learn that the eggs were about ten inches below the sidewalk and certainly not deep enough to be entirely out of the influence of the changing temperature of the year. Appearing fresh when dug up they were placed by Mr. Graham under favorable conditions for hatching, and in due time a lively swarm of locusts issued.

We have, in our own experience, in rearing insects, often known of retarded development both in larvæ and pupæ to the second and even the third year; but in this instance we have a well authenticated case of eggs remaining unhatched for nearly 4½ years. The fact that the species is *Caloptenus spretus* (which, to our knowledge, so abounded around Manhattan in the fall of 1876 that the ground all around the college was absolutely full of eggs) is confirmatory of the statement of Mr. Graham, because the species did not occur there nor in that part of the country last fall, nor in fact during any year since 1877. The eggs above referred to must be a retarded remnant of those which were so thickly laid there in the fall of 1876 and which gave birth to the destructive multitudes of young locusts the ensuing spring.

Promotion of Silk-culture in California.—Mrs. Theodore H. Kittell, corresponding secretary of the California Silk-culture Association, San Francisco, Cal., writes: "We have, through our efforts, succeeded in convincing our people of the practicability of home silk culture, and by lectures, distribution of pamphlets, mulberry seeds, slips and silkworm eggs we have now so animated the public that complete success seems certain, if we shall be able to start a filature for the reeling of the silk produced. Our society takes the liberty of asking you as one of the most urgent workers for silk-culture in America to give us your advice as to a filature, and the best and cheapest mode of preparing the fiber for the market."

We would refer for our opinions on the subjects mentioned to our "Manual of Instructions for the production of Silk," which can be obtained, upon application, of the Commissioner of Agriculture.

Locust Flights in Dakota.—Mr. Geo. W. Hart of Columbia, Brown Co., Dakota, reports that a flight of locusts (*Caloptenus spretus*) passed over that place from 11.30 a. m. to 3.30 p. m. on the 7th of July, coming from S.S.E., the wind being strong and the weather dry. On July 16th, another correspondent, Mr. F.

C. Kelley, of Jamestown, Dakota Ter., reports a flight as passing over that place without giving the direction of the flight. Large numbers of the common dragon-fly, *Diplax rubicundula* Say, were mingled with the locusts.

The Hessian Fly.—In many parts of Central and Southern Illinois and in Missouri this insect has been reported as doing considerable damage, many farmers having to plow up their winter wheat in consequence. Mr. Thomas H. B. Moulder, of Cane Pump, Camden Co., Mo., sent the insect in the flax-seed state, the latter part of June, with the statement that he had forty acres of wheat which all fell or broke down about two weeks before ripening, from the insect's injuries. The western agricultural papers have had abundant notices of the Hessian Fly this season, but as our eastern entomologists, as a rule, do not see those journals, it is more than probable that this year would be put down by them as one in which the species was not heard of or known. The present year is, however, not exceptional, and more or less injury has been done by this insect in the West every year since we have given any attention to entomology.

The genuine Army Worm in the West.—While the reports of the appearance of the army worm in New York, noticed in the July number of the Naturalist, proved to be, as there stated, due to the injuries from *Nephelodes violans* and a supposed Pyralid larva,[1] the true army worm has since appeared in force in Central Illinois and adjacent parts of Indiana, doing much injury during the latter part of July, especially to oats. It has also been reported from Wisconsin and Michigan, but investigation indicates that in those two States other insects have been mistaken for the army worm. There is no question, however, about those in Illinois and Indiana, as we have received specimens from different correspondents, and have had the matter investigated by Mr. L. O. Howard, of the Department of Agriculture. From the facts which he gathered, it would seem that the autumn of last year was rather dry in the region devastated and that this spring was an average and favorable one, being neither unusually wet nor dry. It becomes very evident that the eggs were laid the present year, either by the moths that had hibernated or by a second generation of moths, the latter seeming, from all the facts gathered, most probable.

A New Imported Enemy to Clover.—Again we have to report the sudden appearance in this country of an insect which, though well known in Europe for almost a century, was never known to do any serious harm there to crops. We refer to *Phytonomus punctatus* Fabr., a member of the Curculionid family,

[1] We have since bred the moth from this larva and it proves to be *Crambus vulgivagellus* Clem (= *chalybirostris* Zell). Professor Lintner had previously bred a specimen of what he considered *Crambus exsiccatus*. Both are common species of the genus.

which every one who has traveled in Europe, and has paid any attention to insects, will doubtless have met with under stones, sticks, etc., in pastures and meadows. Mr. L. D. Snook of Barrington, Yates Co., N. Y., sent us during the latter part of July a number of specimens of this beetle, with the statement that it greatly injures clover on his farm. Further particulars as to the nature of the damage have not yet been received. It is worthy of remark, that this imported enemy to clover made its first appearance in the same county from which, three years ago, we first reported another European beetle affecting the same plant, viz., the clover root-borer *(Hylesinus trifolii* Müll).

ANOTHER ENEMY OF THE RICE PLANT.—To the enemies of the rice plant already mentioned and discussed by us elsewhere, viz., *Chalepus trachypygus* and *Lissorhoptus simplex*, we have now to add a third one, and this time of the Order Lepidoptera. It is the larva of *Laphygma frugiperda*, well-known to be destructive to most grasses and grains. Rice suffered greatly from it this summer in Georgia, and we determined the species from specimens sent us by Mr. W. Barnwell, of Savannah.

CANKER WORMS.—One of the next striking examples of devastation by the spring canker worm *(Paleacrita vernata)* which has ever come to our knowledge, is that to the orchards of Mr. J. W. Robeson, of Taswell Co., Ill., which were this year so seriously affected as to be nearly killed and ruined.

LEPIDOPTEROLOGICAL NOTES.[1]—*Ægeria acerni* Clem. (Rep. VI, p. 110).—Mr. D. S. Kellicott has an interesting article in the *Canadian Entomologist* for January, 1881, on the Ægerians inhabiting the vicinity of Buffalo, N. Y., in which he states that the chrysalis of this species in his locality, does not agree with my description as "unarmed," if that description refers to the dorso-abdominal teeth. A re-examination of my specimens shows that my statement applies to the absence of these teeth. It is, however, possible that there is some variation in this regard, and that the eastern specimens from the hard maple differ from the western ones from the soft maple in having the teeth, as indicated by Mr. Kellicott.

Hyphantria textor Harr. (Rep. III, 130).—There is no doubt in my mind, from frequent breeding of specimens, that this is synonymous with *cunea* Drury, and *punctata* Fitch, which are but varieties, Drury's name having priority.

Callimorpha fulvicosta Clem. (Rep. III, 132).—Grote and Robinson give the synonymy of this species in their "List of Lepidoptera of N. A.," etc., *lecontei* Boisd., having priority. The late Jacob Boll bred all the forms from larvæ feeding on the same plant.

[1] From advance sheets of Bulletin VI, U. S. Entomological Commission, by C. V. Riley, being a general index and supplement to the nine Reports on the Insects of Missouri.

Samia columbia Smith (Rep. IV, p. 107).—Mr. Herman Strecker has given a beautiful figure of the male of this species in his "Lepidoptera Rhopaloceres and Heteroceres," etc., 1875 (Pl. XII, Fig. 3), and Mr. F. B. Caulfield has described and figured the larva (*Canadian Entomologist*, X, p. 41, 1878), showing that it is structurally identical with that of *cecropia*, and differs only in the intenser green of the body, in the lateral tubercles and bases of the others being white instead of pale blue, and in the upper thoracic tubercles being of a deeper coral red. It accords more with the *cecropia* larva in the fourth stage. It is placed as a good specimen in Grote's "List of N. A. Platypterices," etc. (Am. Phil. Soc., 1874), but I am still of opinion that it should not be considered a distinct species, but simply a well-marked local color variety worthy of name. There is great variation in color, whether of the larva, cocoon or imago, in *cecropia*.

Callosamia angulifera Walker (Rep. IV, p. 122, note).—This is still considered a good species by systematists. Mr. Akhurst finds that it is rather constant from larvæ which seem to differ in no respect from those of *promethea*, but which feed on the tulip tree (*Liriodendron tulipifera*), and make the cocoon near the ground without pedicel.

Celæna renigera Stephens (Rep. I, p. 86).—Referred by Grote to Hadena. Specimens in the Fitch collection marked with names evidently from Walker, *infecta, egens, defectua, subcadens?* and *murcimaculata* seem to be all synonyms and mere variations.

Prodenia autumnalis Riley (Rep. III, p. 116 and subsequently). —As stated in the eighth report (p. 48) this in the more typical form is recognized as *Laphygma frugiperda* Sm. and Abb. The variety *obscura*, as Professor Zeller, who has seen it, informs me, is so near the European *exigua* Hübn., that it is not easily distinguished.

ANTHROPOLOGY.[1]

THE SACRIFICIAL STONE OF THE CITY OF MEXICO, IS IT GENUINE OR NOT?—In the city of Mexico are offered for sale, casts in plaster of the so-called sacrificial stone now in the courtyard of the museum in the city of Mexico, of which much has been written to prove its genuineness. These casts are much reduced in size, and do not contain the groove of the original. The maker, like many of his countrymen living in the city of Mexico, may not believe in the genuineness of this stone's history; many assert that it was not the sacrificial stone of the Aztecs used in the city of Mexico. No doubt the basin in the center, and groove running from it across the top and down the sides were made after the ornamentation was completed. As this is claimed to represent the journeying of the Aztecs to the city of Mexico, why did they not cut the groove first, then the historical representation?

[1] Edited by Prof. OTIS T. MASON, 1305 Q Street, N. W., Washington, D. C.

As it is, the figures through which the groove is cut, are partially effaced. The groove was evidently cut after the completion of the stone, and in a very rough, uneven manner, passing through the figures in order to give a false importance to a carved stone, which, if allowed to tell its own tale, or, rather, if its history had not been destroyed so as to attach a false representation to it, would still be a valuable monument.

One would think that an object designed for so important a purpose, would have been dressed into shape at the same time, without having to pick up an accidental stone and improvise it for an occasion. If the figures on the surface represent the journeying of the Aztecs to the valley of Mexico, then it did not take many to form the procession. Is there not a great probability that this so-called sacrificial stone had a useful purpose? We are led to this conclusion by seeing scattered about many large round stones, both plain and ornamented, yet without grooves. In the old mills of the early Spaniards, are to be found the very counterparts of these. And why did the Indians want a stone with a hole in it, to retain the heads of prisoners as they were severed? A round object allowing the head to hang over so as to bare the neck for the knife, would be better adapted for the purpose, than to lay the head in a hole with the neck contracted. Is it proved that the Aztecs cut off the heads of their victims? All the stone knives the writer has seen with edges of sufficient length, strength and sharpness, would be poor, slow tools for the cutting off of the numerous heads said to have been daily removed by Montezuma. In the collection of antiquities are several obsidian knives marked "sacrificial knives used by the Aztecs," all of which are better adapted to cut off the tops from turnips and carrots, than human heads, especially if bones were suddenly hit, as the brittleness of these knives would be their speedy destruction. If these so-called Aztecs burnt their dead as a national custom, why accuse them of cutting off human heads to appease their gods? It was only giving the Spanish priests a pretext to call them idolators; so they called it sacrificing human beings. It was good religious capital to work upon. One proof of their burning their dead is, that no graves have been found in the country they occupied, that are older than the Spanish conquest. The Chichimecs, called Aztecs, could not cut off the heads of all their victims; some would die. Why are they not found? There are three skeletons in the museum of the city of Mexico, which were obtained in the old Inquisition building of the city, of those who were starved to death because of their refusal to yield to church dictation. They find no bodies because they were all burnt according to custom. a usage continued to the present day by their kin the Apache, the Yuma, Mojave and others,—plain, simple Indians, not fond of the pageantry attributed to them by the conquerors, who must fictitiously give them importance in order to throw reflected greatness upon their conquest.—*Edward Palmer.*

Ancient Pueblo Workshop.—On the north bank of the Rio San Juan, in Southern Utah, about twenty or thirty miles below the mouth of the Mancos cañon, in the summer of 1875, I discovered the site of an ancient aboriginal workshop, where axes and hatchets had formerly been made in large numbers. On an elevated ledge overlooking the river, I gathered together in the space of half an hour, upwards of twenty stone axes of various sizes and in different stages of manufacture. They were all made of the natural, rounded, water-worn stones of the river, such as we call cobble-stones, varying in length from four to ten inches. As a general thing, the flat stones, which approached most nearly the desired form, had been selected, and the majority of them had simply a groove roughly chipped out around one end. None of the specimens exhibited any traces of surface-pecking. In some examples the edge had been commenced by flaking off small fragments on each side, whilst a few had been superficially sharpened by abrasion. One highly polished celt, of the long, narrow variety, such as the one figured in Hayden's Report for 1876, Pl. xlvi, Fig. 3, and two or three broken specimens were included in the series. They were all found on the surface, scattered through a large number of stones which had evidently been carried there for the same purpose. The ledge or small plateau on which they were found, did not exceed two hundred feet in length and fifty in width.—*E. A. Barber.*

French Anthropology.—The *Revue d'Anthropologie*, Vol. iv, No. 2, April, 1881, furnishes the following communications:

Broca, Paul—Anthropologie Zoologique. La torsion de la humérus et le Tropométre, pp. 193–210.

Benzengre, B.—Etude Anthropologique sur les Tatars de Kassimoff, pp. 211–221.

Hamy, Dr. E. T.—Les Négres de la Vallée du Nil: Impressions et Souvenirs, pp. 222–235.

Bordier, Dr. A.—Japonais et Malais. [A chapter in pathologic Anthropology, being a lecture delivered Jan. 15, 1881, before the "Ecole d'Anthropologie" in the Course of Medical Geography.] pp. 236–246.

Chantre, Ernest—Ancienneté des Nécropoles préhistoriques du Caucase. Renferment des Crânes Macrocéphales. pp. 247–254, plates i, ii.

Kuhff, Dr.—De la Platycnémie dans les races humaines, pp. 255–259.

Rochebrune, Dr. A. T.—Etude morphologique, physiologique, et ethnographique sur la Femme et l'Enfant dans la Race Ouolove, pp. 260–294, plate iii.

Vars, Ed.—Review of the works of N. J. Zograf and H. B. Bozdanov on the Samoyedes, pp. 295–305, with tables.

Mortillet, G. de—Review of the Marquis of Nadaillac's work on the first men and prehistoric times, pp. 306–309.

Zabarowski—Review of Archæology in *Ztschr f. Ethnol.*, Berlin, 1879 and 1880, pp. 309–312; of Hartmann's "Les Peuples de l'Afrique," pp. 330–332; Le Cerveau et ses fonctions, by J. Luys, pp. 336–339.

Martinet, Ludovic—Review of Archæology at the French Association, 1880; *Bulletins de la Soc. d'Anthrop. de Paris*, 1879; and the Archæology of Charents, pp. 312–326; Lesson's "Les Polynésiens, leur origine, leur migrations, leur langage," pp. 339–343.

Deniker—Review of Dr. R. Hartmann's "Der Gorilla Zoologisch—Zootomische Untersuchungen, Lpzg., 1880, pp. 327–330.

Letourneau, Ch.—Review of Le Bon's "L'Homme et les Sociétés leurs origines et leur histoire, Paris, Rothschild, 2 vols., 1879–80," pp. 332–336.

Manouvrier—Review of French and Italian journals, pp. 344–349.

GERMAN ANTHROPOLOGY.—The third part, thirteenth volume, of *Archiv für Anthropologie*, published March, 1881, will be found to contain the following papers:

Kollmann, J. (Basel)—Beiträge zu einer Kraniologie der Europäischen Völker, pp. 179–232, tables II, III, IV.

Scheiber, S. H. (Bukarest)—Untersuchungen über den mittleren Wuchs der Menschen in Ungarn, pp. 233–267.

Hagen, Fritz Bessel—Zur Kritik und Verbesserung der Winkelmessungen am Kopfe; mit besonderer Rücksicht auf ihre Verwendung zu weiteren Schlussfolgerungen und auf ihre mathematisch sichen Bestimmung durch Konstruction und Berechnung, pp. 269–316.

SHORTER COMMUNICATIONS.

Asbóth, O. (Budapest)—Ein Hochzeitsbrauch in Südrussland. Translated from the Russian, pp. 317–321.

Fürst, Carl M. (Stockholm)—Ueber das Vorkommen des Trochants tertius beim Menschen, pp. 321–322.

Fligier, Dr., Reviews of—Miklosich's "Travels in Rumania, Istria and the Carpathians;" Pic's "Origin of the Rumanians;" Diefenbach's "Ethnology of Eastern Europe, especially the Hāmos peninsula and the Lower Danube;" Helbig's "Die Italiker in der Poebene;" Alton's "Beiträge zur Ethnologie Ostladiniens;" Kuno's "Prehistoric Rome;" the Celts; and works by Schwartz, Jirecek, Hasden, Valroger, Robion, Luchaire, Sanpere y Miguel, Alton, Biderman, Benloew, Gerard de Rialle, Tomaschek, Arnold and Kopernicki, pp. 323–335.

Fischer, George—Reviews of the archæological publications of Doctor Lovisato Domenico, and Bandelier's Art of War among the Mexicans, pp. 335–346.

Ecker, A.—Reviews of Bischoff's "Brain weight of Men," and Jöger's "Dictionary of Zoology, Anthropology and Ethnology," pp. 346–351.

As an appendix to part third, we have the fifth installment of a series of elaborate reports upon the great anthropological museums in Germany. The title is as follows: V. Berlin. Das Anthropologische Material des Anatomischen Museums der Königlichen Universität. Erster Theil. Zusammengestellt von Dr. G. Broeseke, im Mai, 1880, pp. I–VIII, 1–87, closely printed. Correspondenz-Blatt, No. 12, 1880, and Nos. 1–2, 1881 close the volume.

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CAMPBELL, PROF. J., M.A. (of Montreal)—Origin of the Aborigines of Canada. A paper read before the Lit. & Hist. Soc. of Quebec. Quebec, *Morning Chronicle*, 1881. Pamph., pp. 33–34.

DOUGLASS, S. J.—The Eskimo Race: its Origin, Migrations and Characteristics. *Good Company*, March–April, pp. 10.

FAILYER, PROF. G. H.—Traces of the Aborigines of Riley county, Kansas. *Tr. Kansas Acad. Sc.*, Vol. VII, 1879–80, p. 132.

INGERSOLL, E.—Personal Recollections of the Utes. *Good Company*, March–April, pp. 8.

MORSE, PROF. E. S.—Prehistoric Man in America. *Kansas City Rev.*, June, 1881, p. 90.

TYLOR, E. B.—Anthropology: an Introduction to the Study of Man and Civilization. N. York, D. Appleton & Co. 1 vol., pp. 448, 78 illus., 12mo.

VERNEAU, D. R.—The Black Races of Oceanica. *Pop. Sc. Month.*, April, pp. 9.

GEOGRAPHY AND TRAVELS.[1]

GEOGRAPHICAL NEWS.—A meeting of representatives of all the German geographical societies, was held at the rooms of the Berlin Society, on the 7th and 8th of June last. Dr. Nachtigal, President of the latter society, was in the chair. In his opening speech Dr. Nachtigal gave some account of the efforts made to form a union of the various geographical societies of the Empire. They include now about 4000 members. A plan of coöperation under the control of an executive body at Berlin, and including the publication of a journal, had been proposed, but met with too much opposition, and was therefore abandoned. Annual meetings for the reading of papers and discussions, was all that could be decided upon at present. At this meeting papers were presented, 1. On the Ways and Means of investigating the condition of the Earth's Center, by Professor Zöppritz [Professor of Geography at the University of Königsberg]; 2. On the Bermudas and their Coral Reefs, by Professor Rein [Professor of Geography at the University of Marburg], founded on observations made by the author during a two years' residence on the islands; 3 On the importance of Magnetic Researches, from the point of view of geography and the study of the earth generally, by Dr. Neumayer [Director of the Imperial German Marine Observatory at Hamburg]; 4. On the Claims of Ethnography, by Dr. Bastian [Director of the Ethnographical Museum at Berlin]; 5. On the Forms of German Houses viewed geographically and historically, by Professor Meitzen [Professor of Statistics at the University of Berlin]; 6. On the Results of earlier Travels with regard to the Botany of Tripoli and the Libyan Desert, by Professor Ascherson [Professor of Botany at the University of Berlin]. An animated discussion on the subject of geographical teaching in the schools took place, leading to the adoption of the following resolutions: "That a combination of geographical with historical instruction led to the injury and neglect of all school teaching; that even if geography is viewed as the only subject which connects physical science and mathematics with history, it should be joined with physical science in the instruction of the upper classes of schools; and lastly, that geography in the Government examinations of teachers, should be admitted as a separate science, and also as an accessory subject assisting to an important degree various other branches of learning." Professor Wagner, of Göttingen, advocated the sketching of maps, and especially the rapid delineation

[1] Edited by ELLIS H. YARNALL, Philadelphia.

of the main features of a country, its ranges of mountains, rivers, etc., as the chief aids in the study of geography, which ought, therefore, to be under the charge of the physical and mathematical teachers, whose sense of form and skill in drawing was far better developed than in teachers of philological and historical subjects.——Dr. Neis, a surgeon in the French navy, has recently made a journey in Indo-China, and discovered the source of the Dong-nai River in 12° 30′ N. lat., 108° 25′ 15″ E. long.——In describing Dr. Heath's recent discoveries on the Beni, as mentioned in the NATURALIST for June, the Proceedings of the Royal Geographical Society says: "As Dr. Heath claims to have been the first white man to see the mouth of the Madre de Dios, it may be interesting to remind our readers that in a paper[1] read before the society on February 25, 1867, our honorary corresponding member, Professor Raimondi, informed us that in March, 1861, Don Faustino Maldonado, of Tarapoto, in Peru, with seven companions, had descended the Madre de Dios into the Mamoré, and that though the leader and three others were drowned in the dangerous rapids called the Calderao do Inferno, the remainder continued the voyage down the Madeira into the Amazon."——A correspondent of the London *Athenæum* has discovered in a copy of the Lyons edition of the "Cosmographia" of Hylacomylus, published in 1514, a map which is the earliest known upon which the name America appears. The new world is represented by a large island in the "Oceanus Occidental," and across it is engraved "America noviter reperta." Heretofore it has been supposed that the most ancient map on which the name appears is the "Typus Orbis," printed at Vienna in 1520.

MICROSCOPY.[2]

MICROGRAPHIC TRACINGS.—In many physiological tracings it has been thought that some of the curves supposed to be of significance may possibly have been the result of oscillations of the lever. It seemed, therefore, to M. Marey, desirable to remove this doubt, and to demonstrate the fidelity of the instruments by showing that identical tracings may be obtained by other instruments which cannot be affected by this cause. This result has been attained by making the scale of record extremely small. If, for instance, the tracings of a sphygmograph are five (5) millimeters high, it is possible that the lever may, in its rapid movement, go too far before the friction arrests it. If, however, the amplitude of the movement is reduced to one-tenth ($\frac{1}{10}$), the effect of the momentum of the lever will be reduced to one-hundredth ($\frac{1}{100}$, the square root) of that which it possessed in the former case. But in order to preserve the form of the trace, the surface on which the lever writes must move very slowly, not more than one (1) millimeter per second. The details of the

[1] R. G. S. Journal, Vol. XXXVII, p. 137.

[2] This department is edited by Dr. R. H. WARD, Troy, N. Y.

curves thus obtained, will not be visible to the naked eye, but if placed under a microscope and magnified twenty (20) diameters, their form can be plainly seen. This method of record has another advantage. Donders has remarked that a recording apparatus is only accurate for movements of a certain rapidity, for which it has been constructed, and if it is made to record movements of much greater rapidity, they are not accurately represented. But the microscopic inscription multiplies almost indefinitely the field of work for the graphic method, by obtaining a sufficiently fine steel point to write, and a black layer thin enough to receive the tracing. M. Marey has already succeeded in receiving and registering the movement of a tuning fork vibrating two hundred (200) times per second, and in recording the vibrations of a voice singing at one end of a tube. Even the vibrations of blood in a vessel, which causes the "bruit de souffle," seem to be among the movements which can be recorded. At least, in the case of elastic tubes and artificial aneurisms, M. Marey has succeeded in recording the vibrations produced by a current of water, and which are also audible. A possible source of error in this method, which must not be overlooked, is the friction of the style against the glass. Momentum and friction are two sources of possible error in all tracings. The former augments with every increase in the range of movement of the lever, the latter with every decrease; and special care will be necessary to reduce the friction to a minimum to avoid this error.—*London Lancet.*

Sea Mosses.—A charming book on this subject, by Rev. A. B. Hervey, a prominent and skillful microscopist, just published by S. E. Cassino, of Boston, will be of the greatest value to microscopical students. Those accustomed to the study of the Algæ, will find it most convenient for determining species; while to all it is full of useful hints as to the character, location and preservation of these attractive objects. The many illustrations are printed in life-like colors, while the text is so arranged that the exquisite sea weeds of our coast, hitherto determined with difficulty, may be analyzed almost as easily as the wayside plants.

Angular Aperture.—The note on this subject, by Mr. Frank Crisp, Secretary of the Royal Microscopical Society, occupies about sixty pages of the journal of the society, and is probably the most elaborate editorial on microscopy ever published. It treats of the theory of microscopical aperture, vision and resolution in a most thorough and systematic manner, utilizing a vast amount of material acquired in correspondence with Professor E. Abbe, of Jena, to whom we are indebted for the first and only rational solution of this complicated problem. Taken in connection with recent papers by Professor Abbe himself, the modern doctrine of wide-angled objectives and resolving power is now for the first time fairly within reach of English readers.

SCIENTIFIC NEWS.

— At a recent meeting of the Anthropological Institute of London, Gen. Pitts Rivers read a paper on the discovery of flint implements in the gravel of the Nile valley, near Thebes. The worked flints were found imbedded two or three meters deep in stratified gravel. From this it appears that the evidence of human workmanship has been found in gravel deposits which had become so indurated that the ancient Egyptians were able to cut flat-topped tombs in it, supported by square pillars of gravel, which have retained their form uninjured to the present day, proving an enormously greater age for the flints imbedded in the gravel, some of which were chiseled out of the sides of the tombs.

— Apropos of the sittings of the Concord School of Philosophers, the same newspaper reports the proceedings of a "chinch-bug convention" in Kansas. It was stoutly maintained by the Philosophers of the Granger School, that chinch-bugs had long been an infliction to farmers; but no one called them such names as one or two of the Concord philosophers bandy about; and we should much prefer being a chinch-bug, luxuriating in the open air, than like a venerable transcendentalist's "soul," to be pent up as if a mere Cysticercus in some one's "occiput."

— Two eminent botanists have recently died: Dr. L. Rabenhorst, of Meissen (Saxony) was a well-known botanist and editor of *Hedwigia*. Among his numerous works was one on the fresh-water diatoms of Germany. Dr. M. J. Schleiden, a prolific writer, and author of "Die Planze" and "Das Meer," died at Frankfort, aged 77 years.

— The fresh-water jelly fish (Limnocodium) has reappeared in the Victoria Regia tank in the Botanical Gardens. Another writer in *Nature* speaks of sea anemones (Actinia) as living and flourishing in a fresh-water aquarium; no particulars are given as to the length of time, etc.

— The first part of a fourth edition of Griffith and Henfrey's Micrographic Dictionary has appeared. It is expected to be completed in twenty-one monthly parts.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Natural History Society of Illinois, June 12.—According to programme the members met at the Palmer House, where several new names were added to the list and some other business was transacted, among which was the organization of the entomologists into a separate section, with C. E. Worthington as president and G. H. French, secretary. The meeting in Chicago numbered about thirty, somewhat smaller than the Ottowa meeting, but that may be accounted for, perhaps, by the fact that the proposed place for the field meeting did not afford so good an opportunity for geologists, and hence they were out in smaller numbers.

On the morning of the 13th the society went by the Mich. Southern R. R., to Whitings, Ind., and from there about a mile and a half to the grounds of the Lake George Sporting Association, the proposed place of rendezvous. This is a tract of wild land containing two or more lakes, low meadow and marsh lands and ridges of timber, in all several thousand acres. A few miles out from here is a belt of pines, the whole giving an exceedingly rich and varied flora and fauna in which all kinds of scientific specialists might find something of interest. The departments of natural history were represented in the field during the week by the following persons:

Geology—Tyler McWhorter, Aledo; L. E. Evans, Streator; Edgar L. Larkin, New Windsor.

Ornithology—J. L. Skelton, Chicago; B. P. Colton, Princeton; Geo. S. White, Lake View.

Ichthyology—Professor S. A. Forbes, Normal; W. H. Garman, Normal; Professor Joshua Lindahl, Rock Island; Frank L. Rice, Evanston; N. S. Davis, Jr., Evanston. The two last also collected Crustacea.

Entomology — C. E. Worthington, Chicago; G. H. French, Carbondale; Dr. E. H. Boardman, Elmira; F. M. Webster, Waterman; W. H. Bridges, Elgin; H. Darlington, Chicago; H. A. Peters, Rock Island. Dr. Boardman and Mr. Bridges worked part of the time in botany.

Botany—Professor E. J. Hill, Englewood; Professor T. J. Burrill, Champaign; Cyrus Kehr, Sterling; Ewing Summers, Chicago; W. J. Stevens, Morris.

There were a number of others at the Chicago meeting, the above list including only those who went out to Lake George.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

American Journal of Science, August.—Geological relations of the limestone belts of Westchester county, New York; Origin of the rocks of the Cortlandt series, by J. D. Dana. Nature of Dictyophyton, by R. P. Whitfield.

Nature, June 2.—A chapter in the history of the Coniferæ. The Cupressineæ.

June 16.—Dr. Miklucho Maclay's Anthropological and Anatomical researches in Melanesia and Australia.

July 7.—Civilization and barbarism in South Africa.

July 14.—British Museum Catalogue of Birds.

Geological Magazine, July.—Two new British Carboniferous insects, by S. H. Scudder. On Vogt's View of the Archæopteryx, by H. G. Seeley. Sudden extinction of the Mammoth, by H. H. Howorth. The Vertebrata of the Forest Bed series of the east of England, by E. T. Newton. Correlation of the Lower Palæozoic rocks of Britain and Scandinavia, by C. Lapworth.

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ON THE DEVELOPMENT OF THE STOMATA OF TRADESCANTIA AND INDIAN CORN.[1]

BY DOUGLASS H. CAMPBELL.

IF we examine a portion of the epidermis from the lower surface of the leaf of the common trailing Tradescantia *(T. vulgaris)*, it will be seen to consist of polygonal cells, mostly irregular hexagons. At intervals, sometimes in nearly straight rows, in other cases irregularly, are found the stomata, each consisting of two semilunar guard-cells, meeting at the ends so as to enclose a central pore, whose walls are thicker than the external walls of the guard-cells. These guard-cells contain chlorophyll in distinct grains, while in the cells of the epidermis it is wanting. Grouped around the stoma are four cells, one on each side, one above and one below. These are very different from the ordinary epidermal cells, being nearly oblong in shape instead of hexagonal. On the stems the epidermal cells are elongated, and although accessory cells are still present, they are much longer and narrower (Fig. XIX). If a vertical section is made through the stoma, the guard-cells as well as the accessory cells are seen to be much shallower than the ordinary epidermal cells, so that a large air-cavity, equal to nearly the area of these four cells is formed beneath the stoma, and communicates with the external air by means of its pore. If we examine as young a leaf as can be had, the epidermis will be found to consist of nearly regular hexagonal cells. When a stoma is to be formed, a septum is formed across one end of a cell, at right angles to the axis of the leaf, thus pro-

[1] Special course of investigation of plant structure and physiology, conducted in the botanical laboratory of the University of Michigan.

PLATE I.

TRADESCANTIA.

ducing a cell whose upper surface is rhomboidal (Plate I, Fig. I).

This cell soon becomes nearly square, and at this tim e, lying between four nearly equal hexagons, it is a difficult matter to see from which it was produced (Fig. II). The cell lengthens so that in a short time it is longer than broad; and the ends are much curved, while the sides are nearly straight. The stoma increases very little in depth from the first, the subsequent growth being nearly all lateral. Soon after the stoma begins to take this oblong shape, two cells, of nearly equal size, and somewhat smaller than the stoma-cell, are cut out from the two epidermal cells at the sides of the stoma (Figs. IV and V), and a little later, in the same way, two similar cells are formed at the ends (Figs. VI and VII). Near the time of the formation of these latter cells, the mother-cell of the stoma shows a tendency to divide, the cell approaching in the meantime nearer and nearer the oval of the perfect stoma. A vertical septum is formed, dividing the mother-cell into two, and as growth progresses these separate in the middle, forming a pore leading to the space beneath (Figs. IX, X and XI). The contents of the stoma are, from the first, denser than those of the epidermal cells, but chlorophyll does not appear until the stoma has attained some size. As it increases in size, the chlorophyll becomes more evident, and shows a tendency to collect in masses, until in the perfect stoma very distinct chlorophyll bodies are present (Figs. X–XIV). The accessory cells grow in about the same ratio as the stoma, so that they bear nearly the same proportion to the completed stoma that they did to the stoma when they were first formed. The air-cavity beneath the stoma is small at first, extending only beneath the stoma proper (Figs. XVII and XVIII), but it increases, extending under the accessory cells, until finally it occupies nearly the whole space beneath them (Figs. XV, XVI). These cells, as well as the stoma proper, increase little in depth after they are first formed. Occasionally the accessory cells are more in number, five or six, but this is rare, and when it does happen, they are crowded so as to occupy little more space than the normal number.

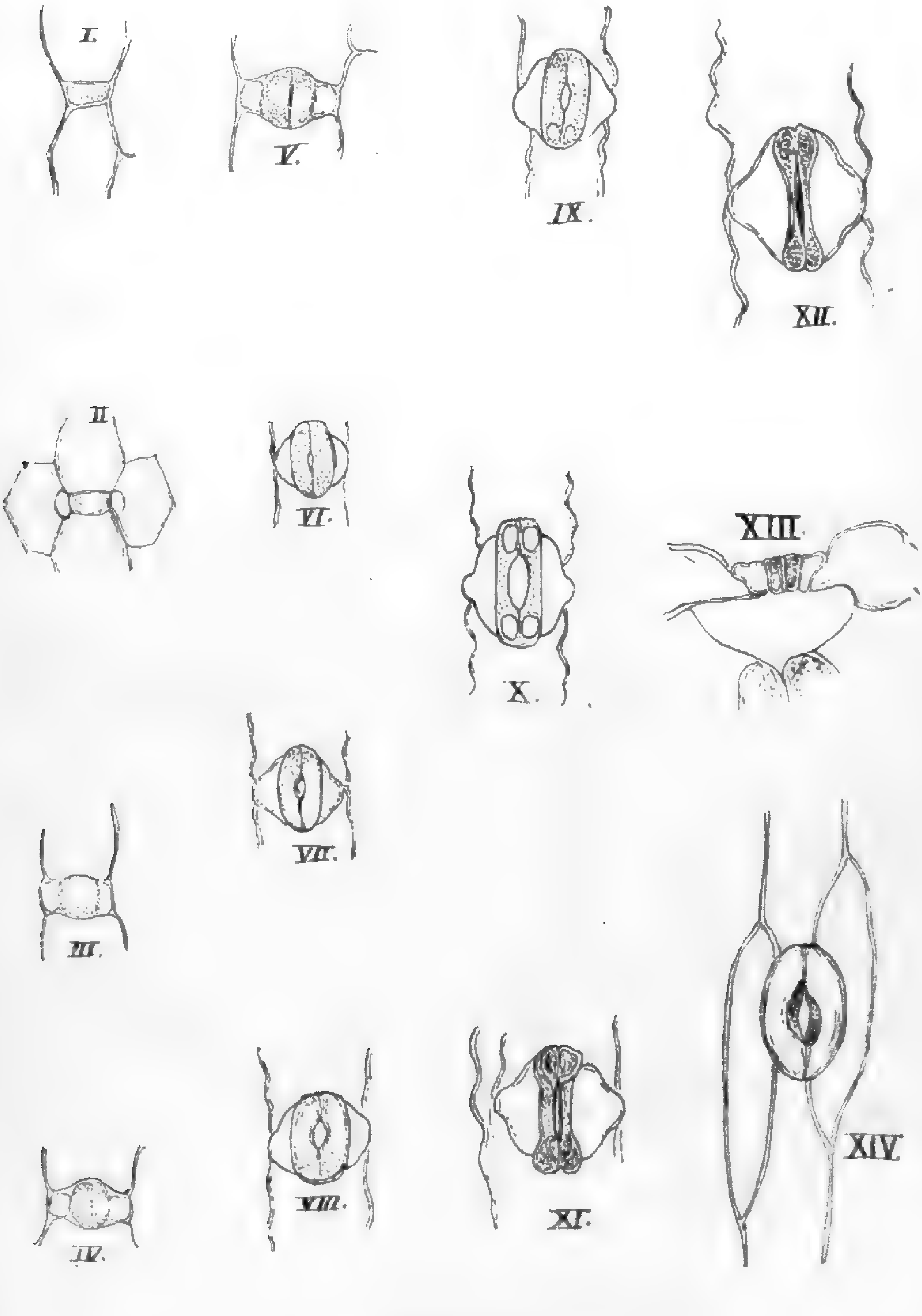
The first thing that strikes one on examining the epidermis of Indian corn, is the peculiar form of the stomata. The guard-cells, apparently, instead of being crescent-shaped, are nearly triangular, and do not meet at the ends, as would be expected.

If, however, the younger forms of the stomata are examined, it is perceived at once, that what were taken as guard-cells are not really such, but are cells corresponding to the accessory cells described in Tradescantia. In the mature leaf the epidermal cells are long and narrow, and have a very marked sinuous outline; but in the young leaf they are proportionately much shorter, and have a nearly straight outline. The formation of a stoma is as follows:

A vertical septum is formed across the end of a cell, shutting off a cell, which is very short (Plate II, Fig. I). This cell, however, lengthens rapidly, and soon is nearly square in shape. The stomata are at first formed in rows, but when mature this regularity is not very obvious. Almost as soon as the mother-cell of the stoma is formed, two small cells, at the sides, are cut out from the adjoining epidermal cells, much as in Tradescantia (Fig. II). These at the outset scarcely keep pace with the development of the mother-cell; but finally grow much faster, and in the end so crowd it as to completely change its shape. The mother-cell rounds off and divides, developing for some time very much as any ordinary stoma (Figs. III–VIII); but when it is about half grown there is a marked change. The stoma gradually begins to lengthen (Fig. IX), and the accessory cells which have hitherto been small and unimportant, begin to grow more rapidly, beginning also to show their triangular form. The stoma becomes more and more elongated, and at this stage is nearly rectangular (X), and two or three times as long as broad. Distinct vacuoles are usually present and situated at the ends, but these soon disappear, and their position marks the place of greatest condensation. From this time, the accessory cells form the most conspicuous part of the stoma. They grow toward the center of the stoma, and in consequence the guard-cells become more and more contracted, until the stoma itself, instead of being oval, as it was when half grown, has become somewhat dumb-bell shaped, and to a casual observer, the accessory cells, which are no part of the stoma proper, might easily seem to be the guard-cells, while the real guard-cells are so altered that they look like mere thickenings around the pore.

The shape of the accessory cells varies somewhat, but is, in general, approximately triangular, or, rather, three-lobed; but sometimes the lobes are so indistinct, that the cells are nearly semicircular, while at others the lobes are so strongly marked as to make the cell approach a trefoil. Occasionally, as in Trades-

PLATE II.



INDIAN CORN.

cantia, the ordinary number of these cells is increased, and an additional one is present; but this is apparently formed by the division of one of the others. Occasionally stomata are also found on the underground stems for some distance below ground. In all such cases they are without the accessory cells, and the guard-cells are of the ordinary shape, and not compressed.

As far as I have been able to ascertain, the form of stomata found in Indian corn is general among the grasses, but usually the stoma proper is neither so narrow nor so much constricted; this is, however, not so in all cases.

In the examination of both these plants, it is necessary to examine the youngest attainable growth, as the stomata are fully formed very early. In Tradescantia, I took the bases of the youngest leaves that I could procure, those that scarcely showed at all without removing the outer leaves, and taking the youngest parts of this, placed it under the microscope without attempting to remove the epidermis. The leaf at this stage of its growth is so thin as to be almost transparent, and by careful focussing, I was able, with little difficulty, to get the youngest forms. In corn I made an oblique section of the stem quite low down, and taking out the bundle of young leaves from within the stem, treated them the same way as in Tradescantia. Only by doing this is it possible to get at the young forms, since any leaf which is firm enough to allow the epidermis to be removed, would show only forms complete, or nearly so.

In the Tradescantia the stomata are confined to the lower surface of the leaves, the upper surface being absolutely without them, while in Indian corn, although they are much more numerous on the lower than on the upper side, they are still found to some extent on the latter.

On first examining the younger forms of the Indian corn stomata, I thought that the accessory cells were formed from the mother-cell by internal division; but after having examined the formation of the accessory cells of Tradescantia, I was struck by the similarity of the two, and on reëxamination of the Indian corn, I was convinced that they were cut out of the adjoining epidermal cells, and were in all respects identical with those around the stomata of Tradescantia.

AN ATTEMPT TO RECONCILE THE DIFFERENCES BETWEEN AUTHORITIES IN REFERENCE TO THE MAYA CALENDAR AND CERTAIN DATES; ALSO TO DETERMINE THE AGE OF THE MANUSCRIPT TROANO.

BY PROFESSOR CYRUS THOMAS.

IN my former paper (AMERICAN NATURALIST for August, 1881), I reached the following conclusions:

First.—That the Ahau or Katun consisted of twenty-four years.

Second.—That but twenty of these years were usually counted.

Third.—That the grand cycle consisted of 312 years.

Fourth.—That the cycles began with the year 1 Cauac, or in other words that the Cauac column in the table of years should stand at the left.

Two important points yet remain to be determined before we are in a condition to compare Maya dates with those of the Christian era:

First.—The position of the different Katunes according to their numbers in the grand cycle.

Second.—Some one year of the Christian era that corresponds with some one year of a given Katun, or, in other words, to determine one or more contemporaneous dates of the two systems.

Before entering upon the discussion of the topic mentioned in the title to this paper, I wish to present the following additional proof that the year series commenced with a Cauac year, as this is a point which must be settled before we can feel certain in regard to any comparison made between dates of the two systems.

In the manuscript discovered by Perez and translated into English by Stephens, we find the following statement:

"In the 13th Ahau, Chief Ajpula died. Six years were wanting to complete the 13th Ahau. This year was counted towards the east of the wheel and began on the 4th Kan. Ajpula died on the 18th day of the month Zip, on 9 Ymix; and that it may be known in numbers, it was the year 1536, sixty years after the demolition of the fortress."

As the years could only begin with one of the four days, Cauac, Kan, Muluc, Ix, which followed each other in the order here given, it is evident this Ahau must have ended on 10 Ix, and must have commenced with 13 Cauac, if we count 24 years to the Ahau. As I have shown in the previous paper that this period consisted of 24 years, I shall assume that point as settled, and will give, opposite, a table of years sufficiently extended to cover one entire grand cycle, also the closing cycle of the preceding, and the first of the following grand cycles, showing the position of the Ahaues.

As the grand cycle includes just 13 Katunes—312 years—I take for granted that the first year of this period coincides with the first year of a Katun, and consequently the close of the former coincides with the close of a Katun. By dividing the former into periods of twenty-four years, we will obtain the positions of the Katunes, and our next step will be to find their respective numbers.

The commencement and ending of the great cycle are marked thus ——◆—— ; the divisions between the Ahaues with single transverse solid black lines. According to the quotation just made from the Perez manuscript, the 13th Ahau was one that required six years to complete it after the year 4 Kan. This can only be found in the one I have numbered XIII (the Roman numerals indicate the numbers of the Ahaues or Katunes). If we take for granted that the periods were numbered thus, 13, 11, 9, 7, 5, 3, 1, 12, 10, 8, 6, 4, 2—a point in reference to which all the authorities agree—having determined the number of one in the grand cycle, it is an easy matter to number the rest.

I call special attention to the fact that the one numbered XIII, found as above stated, begins with the year 13 Cauac; also that the first years of the others correspond with numbers and order as given in the above series. The selection of XIII as the one with which to begin the series, was, as Dr. Valentini has given good reasons for believing, an arbitrary proceeding on the part of the Maya priests.

This numbering, as any one can see, agrees precisely with the position and numbers of the periods marked in table XI of my previous article (p. 639). The position and numbers of these periods, as I have given them here (Table XII) agree exactly with the dates in the Manuscript Troano and the Perez manuscript.

As 4 Kan of the 13th Ahau coincides with the year 1536 of

TABLE XII.

Cauac.	Kan.	Muluc	Ix.
1	2 VII	3	4
5	6	7	8
9	10	11	12
13	1	2	3
	V		
4	5	6	7
8	9	10	11
12	13	1	1326 2)
3) 1327	4	5	6
7	8	9	10
11	12	13	1
	III		
2	3	4	5
6	7	8	9
10	11	12	13) 1350
1351 1)	2	3	4
5	6	7	8
	I		
9	10	11	12
13	1	2	3
4	5	6	7
8	9	10	1374) 11
12) 1375	13	1	2
3	4	5	6
7	8	9	10
	XII		
11	12	13	1
2	3	4	5
6	7	8	1398 9)
10) 1399	11	12	13

1	2	3	4
5	6	7	8
9	10	11	12
	X		
13	1	2	3
4	5	6	1422 7)
8) 1423	9	10	11
12	13	1	2
3	4	5	6
	VIII		
7	8	9	10
11	12	13	1
2	3	4	1446 5)
6) 1447	7	8	9
10	11	12	13
	VI		
1	2	3	4
5	6	7	8
9	10	11	12
13	1	2	1470 3)
4) 1471	5	6	7
8	9	10	11
12	13	1	2
	IV		
3	4	5	6
7	8	9	10
11	12	13	1494 1)
2) 1495	3	4	5
6	7 II	8	9
10	11	12	13

1	2	3	4
5	6 II	7	8
9	10	11	1518 12)
13) 1519	1	2	3
4	5	6	7
8	9	10	11
	XIII		
12	13	1	2
3	4	5	6
7	8	9*	1542 10)
11) 1543	12	13*	1
2	3	4	5
6	7	8	9
10	11	12	13
	XI		
1	2	3	4
5	6	7	1566 8)
9	10	11	12
13	1	2	3
4	5	6	7
	IX		
8	9	10	11
12	13	1	2
3	4	5	1590 6)
7	8	9	10
11	12	13	1
2	3	4	5
	VII		
6	7	8	9
10	11	12	13

1	2	3	4
5	6	7	8
9	10	11	12
13	1	2	3
	V		
4	5	6	7
8	9	10	11
12	13	1	2
3	4	5	6
7	8	9	10
11	12	13	1
	III		
2	3	4	5
6	7	8	9
10	11	12	13
1	2	3	4
5	6	7	8
9	10	11	12
	I		
13	1	2	3
4	5	6	7
8	9	10	11
12	13	1	2
3	4	5	6
7	8	9	10
	XII		
11	12	13	1
2	3	4	5
6	7	8	9
10	11	12	13

the Christian era, we can from this easily change the years of one system into those of the other. For convenience, I have marked on the table the year of our era corresponding with the first and last of each Ahau.[1]

Now let us test this arrangement by the two or three additional dates found on record, and which the authorities have failed to make agree with any explanation of the calendar heretofore given.

Bishop Landa ("Relacion de Cosas," § 41) states that, "The Indians say, for example, that the Spaniards arrived in the City of Merida the year of the nativity of our Lord and Master 1541, which was precisely the first year of 11 Ahau."

As the Indians could have given dates only by their system and by the number of years, it follows that the Bishop connected the year 1541 of the one system with that of the first of the 11th Ahau by his own calculation.

As he understood the twenty usually *counted years* to form a complete Ahau, and supposed one of these to follow another without any intervening years, he would take 9 Muluc of the 13th Ahau—which was 1541 according to my table—as the first of the 11th Ahau (13 Muluc), according to his understanding.

In order to make this plain I have surrounded the usually counted years of the 13th and 11th Ahaues with light waved lines. I have marked the two years he has confounded (9 and 13) with a star; the year 4 Kan of the 13th Ahau, which corresponds with our year 1536, is surrounded by a dark circle.

We know from his express statement that he understood twenty years to constitute one of these periods, a fact which will probably explain the discrepancy in relation to another date which he mentions.

While writing his work in 1566, he remarks, "According to the computation of the Indians, it is now 120 years since Mayapan was abandoned." As this period must have been understood by him to include six Ahaues, the number as corrected would be 144 years, substituting this number and counting back we obtain the year 1422 or 1423—the last year of the 10th Ahau, or first of the 8th, as the one in which the destruction occurred.

Cogulludo (as stated by Dr. Valentini) places this event "about

[1] No notice is taken here of the fractional differences between the years of the two systems.

the year 1420 A. D." The Perez manuscript locates it in the 8th[1] Ahau—the one following the 10th—but without giving the year. As my calculation places it in the last year of the 10th, or first of the 8th, the agreement is perhaps as close as could be expected.

Perez states that the year 1392 of our era was the Maya year 7 Cauac, "according to all sources of information, confirmed by the testimony of Don Cosme de Burgos, one of the conquerors and a writer (but whose observations have been lost."—(Bancroft, II, 763). The correctness of this statement has been very seriously questioned because of the apparent impossibility of making it agree with the other dates. In the first place Perez started wrong by taking for granted that 7 Cauac was the *first year* of an Ahau, a supposition by no means necessary. In the second place it is more than probable he arrived at the date 1392 by calculation from the data he had before him, and not from the fact that the two dates were connected by the authority quoted from. It is certain that he or his authority must have reduced the years of one system to those of the other to have arrived at this date.

As he gives, in his calculations, the year 1493 as that on which Ajpula died, instead of 1536, as stated by his manuscript, thus antedating it by forty-three years, it is probable that this error runs through all his calculated dates. Now let us make this correction on our table by counting from the year 1392, as found there, and see what year it brings us to.

Examining the table, we see that the 12th Ahau closed with 1398, and that 1392, according to my arrangement, was the year 3 Kan of this Ahau. Counting from this forward through the six remaining years of this Ahau, the 24 of the 10th to the 13th year of the 8th Ahau (43 in all), we reach 7 Cauac; precisely the date required by his authorities. It also falls in the 8th Ahau, a fact which also appears to be demanded by his data; but it is the year 1435 of our era and not 1392. Is it not more than probable that this was the year in which Mayalpan was destroyed? It is a little strange that Perez should have made the mistake of saying that Ahau No. 2, in which his manuscript places the first appearance of the Spaniards on the coast of Yucatan, *ended* with the year 1488, and that Dr. Valentini should have overlooked this error. According to my scheme, this Ahau began with 1495 and ended with 1518, covering the correct date.

[1] Brasseur (Relac. des cos. 52 note) says erroneously, "6th."

We see from this that when the Maya calendar is properly explained, and the manifest errors of the various authorities corrected, the dates can be reconciled, and in fact furnish strong evidence of the correctness of what I have advanced in reference to the proper position and numbers of the Ahaues in the grand cycle.

The theory advanced by Perez that the Ahaues were numbered from the second day of the Cauac years, is simply a supposition based upon the name "Ahau," and the fact that the numbers of these periods, as usually given, can be found in this way, and is really the basis of all his calculations.

But we can find the same numbers, and in the order given, without resorting to this theory, as will be seen by reference to the table. Dividing the series into periods of 24 years will necessarily give these numbers as the first years, no matter where we commence the division. As will be seen by reference to the table, the Ahau in which the year 1536 falls, and which the Perez manuscript states was the 13th, commences with the year 13 Cauac, the next with 11 Cauac, and so on, precisely as given by all authorities. The only foundation, therefore, for the theory advanced by Perez, was the name "Ahau," which was doubtless applied to these periods on account of their importance in calculations of time and in giving dates.

Is there anything in the manuscript itself indicating the date at which it, or the original from which the one discovered was copied, was written?

The period embraced by the four plates XX–XXIII, which can be located in the series of years with reasonable if not absolute certainty, is evidently peculiar and not a part of the Maya calendar system. If, as I have given strong reasons for believing, it marks the close of one great cycle and the commencement of another, it will be located as shown by the heavy waved line on the table.

Why was this peculiar period given? My answer is that it probably marks the time during which the author lived, and hence was written during the latter half of the fourteenth century.

That exactly the same combinations may be found by going back one grand cycle, or 312 years, is true, but the internal as well as the external evidence, which I cannot undertake to discuss here, will not, in my opinion, allow us to carry it back to such a remote period as the commencement of the eleventh century: that we cannot bring it down to the middle of the seventeenth century (the only possible subsequent date on the above supposition) must be admitted.

That the peculiar period embraced in plates XX–XXIII may be located where any two cycles meet is certainly true, so far as the years are concerned, but judging by the symbols and extent of the period, certain signs which seem to indicate the 3d and 1st Ahau, and from the fact that the commencement of no other cycle, except that with which the grand cycle begins, coincides with the commencement of an Ahau, I am satisfied it marks the union of two of the greatest Maya periods.[1]

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THE SIPHONOPHORES.

III.—PHYSOPHORIDÆ (ANIMALS CLOSELY RELATED TO AGALMA).

BY J. WALTER FEWKES.

In the two previous articles[2] in the NATURALIST, we have sketched in outline the anatomy and development of Agalma, which is regarded as the typical genus of a family of tubular jelly-fishes to which is given the name of Physophoridæ, in distinction from others yet to be mentioned, which are but distantly related to the type chosen. Before we go further a consideration of the different genera found in this family may be of interest to our readers.

All the genera now to be described agree in this particular, that they have a float, or air bladder, to support themselves in the water in which they live. Stem may fail, the attached nectocalyces, covering-scales and "tasters" be wanting, but the float always remains with the feeding-polyps, tentacles and sexual-bells represented in some form or other. To trace the different modifications in structure among the members of the group, and to show how now one part, and now another is modified, yet leading to no new plan of structure, is a most interesting and

[1] *Errata in the First Article.*—In second line from the bottom of page 631, after the words "17th day of the 2d" add "or 15th," so as to read "17th day of the 2d or 15th month." In third line from the top of page 636, for "governing" read "covering." In second line from the top of page 639, for "each period" read "each two periods."

[2] NATURALIST, September, 1880, March, 1881.

instructive study of these forms of life. Let us, therefore, consider in turn the more important genera allied to Agalma which constitute the so-called Physophoridæ.

FIG. 11. — Rhizophysa.

One of the simplest members of the group is a genus in which we have present, as it were the mere skeleton of the Agalma, or simply the float and the stem. To this stem is added feeding polyps and sexual-bells, while all other appendages, as necto-calyces, covering-scales, "tasters" and the like, are wanting. It is, in fact, as if the Agalma had dropped all such as superfluous, and retained only those parts necessary for its life; polyps to eat for the community, a float to support the stem in the water, and sexual organs to reproduce new colonies. We are to consider a genus which is one of the simplest, and on that account can very properly be described in this place.

The name of the animal to which reference is made, is Rhizophysa, which is one of the rare Siphonophores of the Mediterranean and other seas. Its bizarre form and simplicity of structure gives to it an interest second to none of the Physophoridæ, and as is the case with a study of all aberrant forms, a few words about its general anatomy may do something to bring about a better understanding of the group of jelly-fishes, of which Agalma may rightly be regarded a representative. The body of Rhizophysa is a simple, flexible, transparent tube, at one end of which is a float (a), Fig. 11, filled with air to support it in the water. This tube, besides being extremely flexible, is highly muscular, and can be contracted into a shapeless snarl under the air bladder, or elongated into a straight, transparent, thread-like axis, as shown in the figure. Sensitive to the least touch of a foreign body, it is seldom quiet, contracting or expanding its length by muscular action of the stem walls. In no respect does this axis differ from that of Agalma, with which it is morphologically identical.

The appendages to the axis are few in number, but very important. Whatever structures hang from its walls are those only which are necessary to the life of an animal so low in structure as Rhizophysa. There are no swimming-bells for propulsion through the water. It is a passive agent of wind and tide, and like many other pelagic animals, irrespective of itself is helplessly borne along hither and thither as they carry it. Covering-scales also fail along the stem, for they likewise are needless in an organism of this low kind. The organs necessary to the life of the animal, those of digestion and reproduction, cannot fail, and these are all which are to be found appended to the walls of the body of Rhizophysa.

At intervals along the stem, when expanded as shown in Fig. 11,[1] there will be noticed flask-shaped bodies, which closely resemble the polypites of the Agalma colony. These are the "feeding-mouths," and if the distal end of each of these bodies be examined, an opening through which the food is taken in will be found, while in the cavity of the polypite the half digested fragments of small animals betray at once the character of these bodies. The cavity of this polypite communicates with that of the body extending from one end to the other of the axis, through which it is brought into connection with the interior of every other organ of the animal.

From the base of each of these feeding-polyps, there hangs down a long tentacle, beset along its whole length with pendants or tentacular-knobs of a form very different from that of the Agalma. There are three kinds of these pendants, each of which has a characteristic shape which is very different from that figured in my former article, as of the tentacular-knob of *Agalma elegans.* There is no other structure in the organization of the Siphonophore which varies so much and assumes such a variety of form as the tentacular-knobs, and upon these differences we rely in the main for generic and specific characteristics among the Siphonophores. Rhizophysa has three kinds of these tentacular appendages, and in that respect differs from most other Siphonophores where only one form of pendant is found in the adult.

[1] **Fig. 11 was taken from a paper by the author of this sketch in Proc. Bost. Soc. Nat. History, Vol. XX.**

Midway between each pair of polypites on the axis of Rhizophysa, there will be noticed a small cluster (*e*), which when magnified will be found to have a botryoidal shape and to hang from the axis by a small slender pedicel. These organs are ovaries, and correspond with the sexual bells of the Agalma colony, although they never take on a bell shape as is true of the latter genus. How the egg is formed in these clusters, and what the character of the development of Rhizophysa is, no one has yet been able to make out with any degree of certainty.

In recapitulation, these then are the only structures which the skeleton-like Rhizophysa has : an axis *(b)*, with a terminal float *(a)*, polypites, or feeding-polyps, *(c)*, from which arise many tentacles *(d)*, closely set with tentacular knobs, and sexual organs *(e)* in the form of botryoidal clusters situated midway between each pair of feeding-polyps.

In Rhizophysa we have one of the simplest expressions of the group of animals of which Agalma has been taken as a type. There is but one simpler related animal, and that is a form in which the stem is wholly wanting, and nothing remains to indicate the affinities of the animal with the Physophoridæ except the float. We then have a well-known Siphonophore commonly figured as a representative of the group and called Physalia, or the Portuguese man-of-war.

In this curious animal there is no sign, whatsoever, of stem, swimming-bell or covering-scales, and the float is enormously developed into a bladder, which swims on the surface of the water, and acts in a way as a sail, to the spread of surface in which a raised crest also contributes. The colony of individuals is clustered on its under side, and in that position is borne along through the water. Physalia is, in some respects, the simplest possible form of Physophore and most distantly removed from the type, Agalma. Its close relation to Rhizophysa indicates that it is a true member of the group and not closely related to the floating hydroids Velella and Porpita, which I have already followed McCrady in separating from the Siphonophores.[1]

The genus Physophora or the "float-bearer," which has given the name of Physophoridæ to the group, is not perfectly normal, and differs in some respects from the type Agalma. Physophora has never been found in American waters, although quite com-

[1] Bull. Mus. Comp. Zool., Vol. VI, No. 7.

mon in the Mediterranean, and found likewise in the Atlantic near the Cape Verde islands. It is one of the most beautiful and graceful of all the group to which it belongs.

Physophora differs from Agalma and from all other Physophoridæ in this particular, that the polyp-stem to which is affixed polypites, covering-scales, tasters and sexual organs in Agalma, and which takes on the form of a long tube in this animal, becomes reduced in length in Physophora and inflated into a special bag, from the under side of which, in a definite spiral arrangement, structures similar to those of the polyp-stem in the Agalma, hang. It is precisely what would be expected if the portion of the axis of Agalma below the lowest nectocalyx were inflated into a sac, and the appended structures drawn into a spiral line over its under surface. The nectocalyces and the nectostem do not essentially differ in the type and in Physophora. The peculiar tentacular pendants of this animal I will not consider at length, since an account of them would draw me into a description too technical for these papers.

One genus of the Physophoridæ, closely related to the young of Agalma, remains yet to be mentioned. It will be remembered that we described the Agalma as passing through what was called an Athorybia stage. That form is permanently taken by the genus Athorybia, from which it was named. The resemblance of the two is, however, only a likeness in general shape, and is, in particulars, quite remote, for when we study the form of the covering-scales, the tentacular pendants and the fine anatomy of the float, we find very little resemblance between the two. The term "Athorybia stage" is a very convenient one to designate a well marked larval condition of the young even of other genera besides Agalma.

In the genus Athorybia there are no nectocalyces, and if any axis is developed, it is so small as to be practically wanting. In place of swimming-bells, the covering-scales are capable of quite extended motion, and arise directly under the base of the float, thus forming a crown or circlet which encloses that body. To the outline and arrangement of these structures, as well as the complete absence of nectocalyces, Athorybia owes its peculiar shape. It is probably an arrested embryonic condition resembling closely the young of Agalma, although differing from it in structural details.

There remains among the Physophoridæ, closely resembling in general outline the type Agalma, several genera which should be mentioned in this place. One of these is so well marked that it can be easily distinguished at a glance, and in one important particular is different from all the other Physophores. It will be remembered in my account of the arrangement of the swimming-bells of Agalma, published in the first article of this series, that I described these organs as arranged in two rows, the lines of the two series apparently opposite on the axis. As is true also of other genera, where nectocalyces occur, this appearance of being placed in two rows on different sides of the stem, is brought about by a twisting of the axis itself, and not by a formation of the bells on opposite sides. If the axis of Agalma has its fibers straightened, all the covering-scales, swimming-bells and the like, would be found one above the other in a line. Consequently the biserial arrangement of the swimming-bells is wholly distinct from their place of apparent origin on the axis, but dependent upon the twisting of the axis itself. In the genus Stephanomia,[1] instead of the section of the stem between the position of origin of two nectocalyces taking a turn through an angle of 180°, thus bringing the nectocalyces into two series; the stem between two adjoining swimming-bells is twisted at a smaller angle, even one less than a right angle, so that the openings of the bell cavity face on all sides. There still remains a serial arrangement of the bells, but in Stephanomia it is no longer biserial as in Agalma, but multiserial with the bells opening in all directions in a plane at right angles to the axis. The polyp-stem in this beautiful genus resembles that of an Agalma, but the feeding-polyps are mounted upon long peduncles, so that the tentacles seem to originate on the polypites midway between the stem and the mouth. Covering-scales of peculiar outline are also present, as well as "tasters," and male and female sexual-bells. In all of these structures, the genus is very characteristic, and if its whole organization be considered, is probably the highest member of the family. The arrangement of the swimming-bells, opening as they apparently do on all sides of the stem, make it possible for the whole colony to move rapidly through the water, and nothing can excel the grace with which these animals make their way through

[1] This genus was commonly called Foskalia by European naturalists; Stephanomia has a prior claim as its true name.

Fig. 12.—Agalmopsis.

their native element, when the combined movements of different series of bells impart a spiral motion to the whole colony. In truth, the grace of this animal is something marvelous, and when once seen is not soon to be forgotten.

There are two genera of Physophores closely resembling Agalma in external shape, but so well marked that they are commonly placed in different genera. They are known as Agalmopsis, and Halistemma. The likeness of the former of these animals to Agalma, as its name betrays, is very great (Fig. 12[1]). The most important difference between the two is in the structure of the tentacular-knobs, which in Agalmopsis (Fig. 13) have but a single terminal filament, while in Agalma, as has been already pointed out, there are two of these terminal filaments and an intermediate vesicle. In minor details also, as in the position of the sexual-bells upon the base of the "tasters," instead of midway between the feeding-polyps on the stem, Agalmopsis differs from Agalma, but as has been already said, the general outline of the two is much the same.

The genus called Halistemma, or "sea-tube," approaches very closely, in form, the type Agalma. The great difference between the two, as between Agalmopsis and

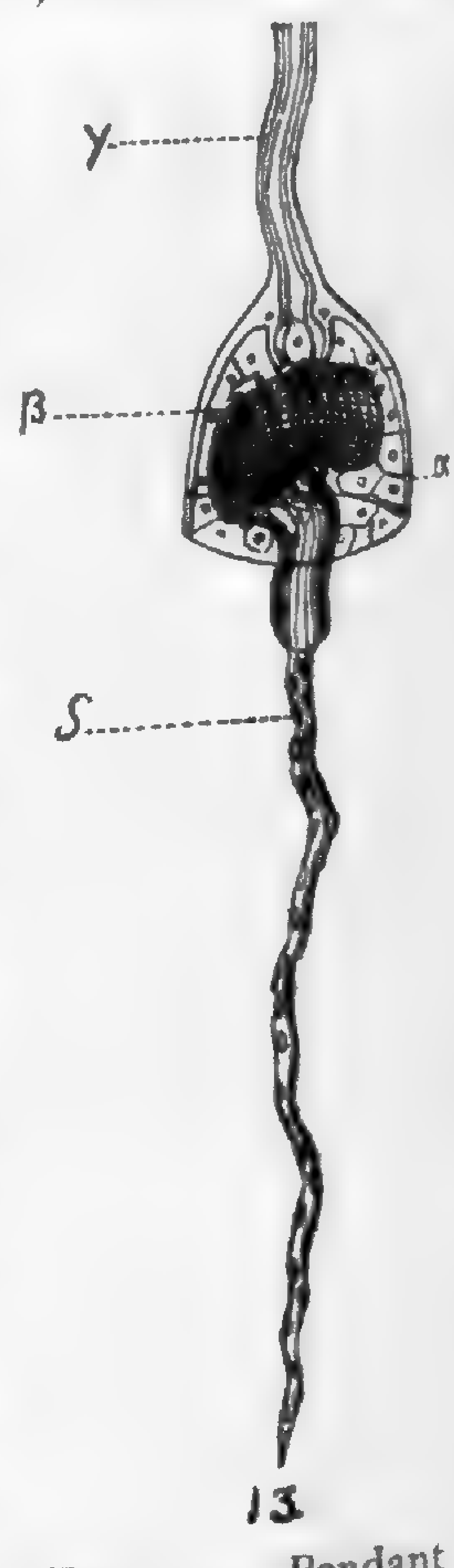

Fig. 13.—Pendant knob of Agalmopsis.

[1] Figs. 12 and 13 are copied from my paper in the Bull. Mus. Comp. Zool., Vol. VI, No. 7.

Agalma, lies in the form and arrangement of the pendant tentacular-

FIG. 14.—Apolemia.

knobs. In Halistemma as in Agalmopsis, there is but a single terminal filament on each knob, but there is no involucrum such as we have already shown covers the "sacculus," or body of the knob in Agalma. Moreover, these knobs do not hang from tentacles, but each one is suspended separately from the base of the polypite, and what appear to be tentacles are in reality their pedicels very much elongated.

All the genera mentioned in the previous pages constitute a natural group of float-bearing jelly-fishes. They are closely allied to one another, and all possess an air bladder or float.

There remains one more genus to be described, which is doubly interesting from its great size and its relationship to a group of tubular jelly-fishes which has little in common with Agalma. This genus is called Apolemia, and is known to the Italian fishermen, on whose shores it is most abundant, as the "lana di mare," or wool of the sea. It often reaches, when extended, a length of from twenty to thirty feet, and is seldom found entire, but generally in the form of broken fragments like that figured in Fig. 14.[1]

The main difference between Apolemia and Agalma lies in the fact, that while in the latter the covering-scales are fastened along the whole length of the polyp-stem, and no visible break occurs where these structures are not found, in Apolemia the feeding-polyps and covering-scales are united together in clusters at intervals on the stem, separated from each other by a bare portion *(d)* of the axis, which is destitute of appendages of any kind. The fragment figured above gives a general view of a portion of such an Apolemia, but if the whole colony were figured and the remainder of the axis shown, upon one end would be found a float just as in Agalma, and four or five pairs of swimming-bells, arranged in a like biserial manner. There is, however, this peculiarity of the portion of the stem, which bears the nectocalyces in Apolemia, that from it also hang bodies closely resembling "tasters," yet destitute of tentacular filaments. This is, as far as I know, the only instance among the Physophoridæ where the nectostem has tasters arising from it. They are not as a consequence found along the polyp-stem as in most other genera.

If now we turn our attention to an examination of the clusters of bodies arranged at intervals along the polyp-stem as in Fig. 13, we find each cluster of peculiar shape, differing greatly from

[1] The figure (Fig. 14) was copied from the Bull. Mus. Comp. Zool., Vol. VI, No. 7.

what we have already studied. The stem, half way between each cluster *(r)*, is jointed so that as the animal grows, or the stem elongates, that cluster most distant from the float ruptures its connection with the colony at the joint in the axis, and when separated from the remainder, leads an independent life. It thus happens that these little clusters are often found floating alone in the water, hanging from the fragment of the stem, having broken their connection with the parent, or rather with the colony, to which they were formerly attached. As is also the case in a larval stage of a common jelly-fish, Aurelia, known as the strobila, which is, however, attached at one extremity to the ground, successive terminal members continually separate from the collection and swimming away, develop into new Aureliæ, so terminal clusters of the free-swimming Apolemia are successively broken off from the colony as it matures. The likeness between the method by which Aurelia and the clusters of Apolemia develop is morphologically very great. Let us consider the composition of a single cluster which has separated in this way from the colony, and see how far this likeness can be traced.

The fragment of an Apolemia ruptured from the remainder of the colony, resembles closely in shape a number of transparent spheres fastened together by one pole, from which hang down a number of polyp-like organs. The cluster is, in the main, composed of many jelly-like bodies joined together on the fragment of the stem. These bodies are but modified covering-scales, and are generally penetrated by a single tube, just as is found universally to be the case among other genera. The covering-scales are carried uppermost as the cluster floats in the water. From the lower side, and also attached to a segment of the axis, there hangs down the same flask-shaped feeding-polyps *(f)*, which have been described in Agalma. The tentacles *(c)* of the feeding-polyps do not bear pendants as are found in all the other Physophores except Physalia. In each cluster of polyps there are two flask-like bodies, in general shape not different from the remaining, which have a bright red color. We are unable to assign any reason for this peculiar coloration in these two feeding-polyps. Lastly, in each cluster of the Apolemia colony we find sexual-bells, male and female, which fill out the complement of organs necessary for the independent life of the cluster.

On account of this independence of life in each cluster, when separated from the colony, it is evident that we have a condition of life in this instance very different from that usually met with among lower animals, especially among the jelly-fishes. Apolemia is, without question, a colony composed of many members, which in younger stages are attached together in the form of a Siphonophore, but as it grows older, each colony breaks up into many fragments, each of which lives wholly independent of its neighbor. The growth of a fragment after it has been separated from its connections, has never been traced, and it is not known how long or short that life may be, but in other genera belonging to a group of Siphonophores, quite unlike the Physophoridæ, the whole history of the growth of such a fragment has been followed. Apolemia is very interesting from its relationship to this form known as Diphyes, the type of a large family of Siphonophores called the Diphyidæ. The anatomy of this animal will be pointed out in a paper to follow the present, after which its curious relatives can be better understood, and the reasons why they are not placed in the group with Agalma better appreciated.

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THE LOESS IN CENTRAL IOWA.

BY R. ELLSWORTH CALL.

ON the 16th of May last, the writer discovered unmistakable loess under and around the city of Des Moines. Following are the details of the discovery, and such notes thereon as may be of general interest.

It might be well to remark that this formation has hitherto been known only in Western and Southwestern Iowa, as has been reported by the various surveys and explorations sustained by the General and State Governments; and in Southeastern Iowa, as reported on to the Muscatine Academy of Science, by Professor F. M. Witter, formerly of that city. He found the loess under certain portions of Muscatine, with its characteristic fossils, a list of which, if my memory serves me, he reported with his paper. A reference is made (White's Geology of Iowa, Vol. I, p. 114, foot note) to a deposit of the loess near the source of one of the branches of the Raccoon, east of the great water-shed of the State, but which of the three branches of the Raccoon is meant, or the locality of the deposit, is not indicated.

The occurrence of the loess in extensive outcrops, over areas subjected at a previous time to geological investigation, but of which no mention is made, and that, too, in Central Iowa, was wholly unexpected. The formation was first seen, and its true nature surmised, at a point some two and one-half miles west of the city of Des Moines, on a branch cut of the C. R. I. & P. R. R. The cutting was made in the course of building a branch to the State Fair Grounds, in the summer of 1880, but the nature and true geological age of the material through which it passed seems to have remained wholly unknown. Subsequently outcrops were seen and studied at various places in and around the city, and specimens of the soil, the characteristic concretions and fossils, were taken from them all. Some of these exposures, owing to recent excavations like those in process of completion on Capitol Hill, in East Des Moines, show the deposit to be very extensive, and indicate that the higher lands, for some distance to the east and west of the Des Moines river in this locality, are composed in great part of true loess.

FIG. 1.—Section across Des Moines river, above the city of Des Moines, Iowa. 1, Terrace; 2, loess; 3, drift; 4, clay.

Fig. 1 is representative of an actual section, as it may be seen at a point some three and one half miles above the city of Des Moines, on the river of that name. It will be seen from this section that the loess forms the bluff or face of the *third terrace*, and probably forms the mass of the higher land in the immediate vicinity of the stream. Beneath the loess is found the drift, and beneath that again the clays of the coal measures. The river has cut its channel, by corrasion, through the formations mentioned, and in some localities has eroded a channel through the sandstones found beneath the clays. Geologists will be able to form their own conclusions from these *data*, and see in them, perhaps, some of the results of those great continental oscillations which have contributed so wonderfully to change the physical aspects of this region. The number and height of the terraces indicate extensive areas of depression and subsequent elevation.

It might here be noted that the lithological or physical features of these local deposits differ in no appreciable degree from the loess of the Missouri valley, with which it is probably synchronous, and also of the same ultimate origin. The fossils found in the loess at this point thus far, are a single spine of a fish, among the vertebrates, and among the invertebrates the following land and fresh-water shells: *Mesodon thyroides* Say, *Patula alternata* Say, *P. striatella* Anth., *Hyalina arborea* Say, *Vallonia pulchella* Müller, *Stenotrema monodon* Rack., *Helicodiscus lineatus* Say, *Strobila labyrinthica* Say, *Pupa fallax* Say, *P. armifera* Say, *P. pentadon* Say, *Helicina oculata* Say, *Succinea obliqua* Sar., *Limnophysa humilis* Say, and *Limnophysa desidiosa (?)* Say. Another species of the subgenus Patula, is, perhaps, *P. strigosa* Gould, and is represented by four specimens not well preserved. Root marks abound in some parts of the exposures. The woody matter having decayed, has left the cavity partially filled with carbonaceous material, while the mass of the concretion-like remains thus referred to vegetable origin, is strongly impregnated with the sesquioxide of iron. The presence of this oxide is in itself one of the strong reasons for regarding these remains as fragments of fossilized roots. It is not here necessary to revert to the composition of roots, for the reason that the fact of their containing a large per cent. of oxide of iron is well known. It has been thought best to record simply the finding of the loess in this vicinity, and leave to others the forming of any theories of the deposit.

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NOTES ON THE EARLY LARVAL STAGES OF THE FIDDLER CRAB, AND OF ALPHEUS.

BY A. S. PACKARD, JR.

The Zoëa of Gelasimus pugnax.—While at Fort Macon, North Carolina, in 1870, I collected a number of the common fiddler crab (*Gelasimus pugnax* Smith) with eggs. May 15th segmentation had in some just taken place, the blastoderm having formed, while in others the zoëæ were about ready to hatch, and were seen to be surrounded in the eggs by a delicate larval membrane.

For want of time the crabs bearing the eggs were placed in alcohol and studied after my return to Salem. Hoping to get another opportunity to study the living embryos and larvæ, after waiting about ten years expecting that some of our carcinologists might describe the transformations of this interesting crab, I have decided to offer the following slight contribution to the subject, with the hope that a complete history of the development of the fiddler crab may yet be worked out.

Several eggs were observed in which one, two, or sometimes three large nucleated and nucleolated (blastodermic) cells (Fig. 1, *A*) were observed lying on the periphery of the egg; they were more or less flattened, and the yolk on which they rested was hollowed out under them. When the chorion is ruptured they pass out whole as large round cells *(d)*. Their large size seems unusual for polar blastodermic cells. They all appear to be, however, waste segmentation cells. In eggs farther advanced, and after the blastoderm has appeared, the yolk is seen to be surrounded by a distinct membrane.

In the next stages observed (*B*), the zoëa, with its appendages and large, dark, sessile eyes was formed. (*C*, the same freed from the egg shell or chorion.)

Upon rupturing the egg-membrane of the alcoholic specimens, I was enabled to work out the form of the larva just before hatching. The cephalothorax is large and spherical, not segmented, while the abdomen is long and slender, and composed of six definite somites; the last one ending in a forked tail, the rounded lobes provided each with three long setæ or bristles (*D*). I could detect no frontal or dorsal spine, though they were probably present in a rudimentary form. The antennæ are as represented at Fig. 1, I, II; the upper antenna (I) is conical, short and thick, without any terminal seta; while the second or lower antenna (II) is much slenderer, rather longer, and ends in four very unequal setæ, the second seta from above being very much the larger. The mandibles are simple, and I could detect no palpus. The first maxilla (IV) is two lobed, the lobes representing two endopodites; the upper (palpus) is about half as thick as the lower, and the seta hair-like; those of the first (lower) endopodite are spine-like. Of the second maxilla (V) only the three inner lobes or endopodites were observed, the exopodites or what corresponds to the gill and scraper of the adult crab, unfortunately not having been worked out. The two maxillipeds (VI, VII) repeat each other in form; the basal joint giving rise to a simple

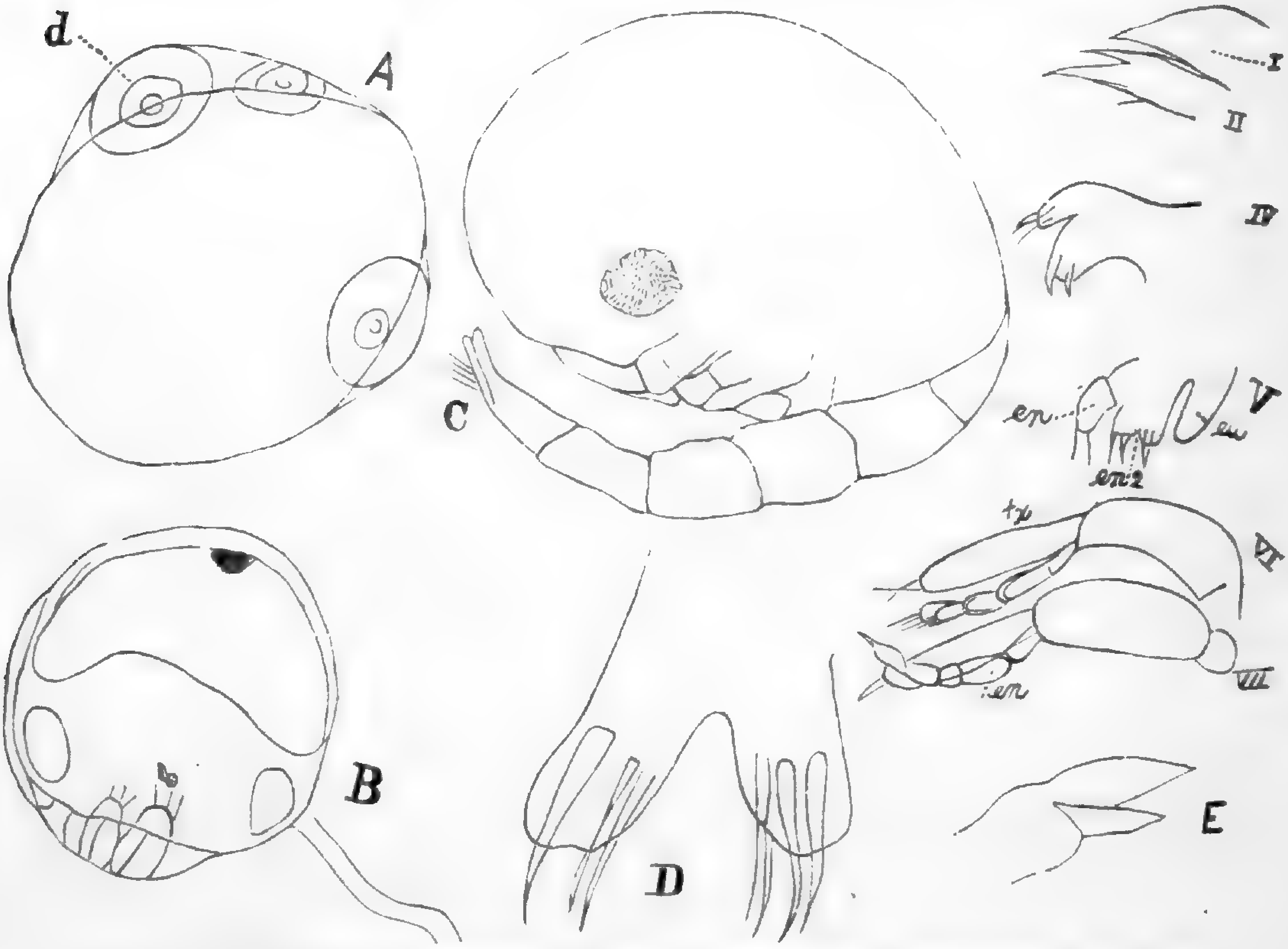

FIG. 1.—A–D, young of Fiddler Crab; E, abdominal leg of larval Alpheus.

exopodite (*ex*) and a four-jointed endopodite (*en*) in the first maxilliped, and a five-jointed one in the second. The new joints of the zoëa of the second stage and the first larval skin are to be seen in the figure.

Our knowledge of the zoëa forms of the crabs, or Brachyurous Decapoda is really quite limited, especially when we consider the first larval stage. Careful studies on the embryonic zoëa-forms only comprise those of Professor S. I. Smith and Mr. W. Faxon on the early stages of Hippa, those of Faxon and Professor Brooks on the early stages of Porcellana, and those of Faxon on the early stages of *Carcinus mænas* and *Panopæus sayi.* Now the zoëa of Porcellana, Hippa and Pagurus are, in the abdominal and other characters, quite different from those of the higher crabs, and approach those of the shrimps and other Anomura, and this is what we might expect, as these forms are intermediate between the shrimps and true crabs. It is a matter of considerable interest to learn something of the zoëa of Gelasimus, as with Ocypoda it stands at the head of the crabs, above Cancer, Carcinus, Panopæus, etc.

Comparing our Gelasimus larva, artificially removed from the egg, with Faxon's beautiful figures[1] (1, 2) of the embryonic zoëa of Carcinus shortly before hatching (his Fig. 9 representing the larva in the act of exuviating the larval skin);[2] the first antennæ are seen to be much shorter and proportionately stouter than in the remarkably developed antennæ of Carcinus, being more as in the zoëa stage; the second antennæ have nearly the same general form as in the zoëa after molting; the spine (exopodite), squamiform appendage (endopodite), and rudimentary flagellum being indicated. The antennæ of our embryo Gelasimus do not appear, then, to have the great development found by Faxon to exist in Carcinus of the same or nearly the same age. Faxon has not represented the first maxillæ, but it is two-lobed, the lower larger lobe probably being later in life differentiated into two endopodites; the second maxillæ differ from Faxon's figure of the embryonic zoëa of Panopæus in not being divided into four endopodites equal in size and form, but into three endopodites, the second (v en^2) being deeply lobed, and the third (v en^3) being two-jointed. They, however, are nearly identical in form with the second maxillæ of Cyclograpsus as figured by Müller.[3]

The endopodites of the first and second maxillipeds differ from those of Carcinus in having five joints, Carcinus having four joints to the endopodites of the first pair and only two in the second pair; in Cyclograpsus, however, Müller figures three, and as Gelasimus stands higher in the series than Cyclograpsus, it is possible that Gelasimus is, in this respect, more differentiated. (All of my drawings were made with the camera, though it is possible I may have been in error in drawing too many joints.)

The tail of our embryonic Gelasimus also shows no such extreme development as discovered in Carcinus by Faxon, and in this respect it is like Cyclograpsus (Müller's Fig. 18); and hence I am inclined to the supposition that Gelasimus before the first

[1] On some points in the structure of the embryonic zoëa. By Walter Faxon. Bulletin Mus. Comp. Zoology, VI, No. 10. Pl. II, Fig. 1.

[2] We see no reason for not homologizing this membrane with the amnion of insects and of Limulus and Apus.

[3] See Facts for Darwin. English translation, p. 50, Fig. 18. Our Gelasimus zoëa appears to agree much more closely with the zoëa of Müller's marsh crab (Cyclograpsus) than with that of Carcinus or Panopæus, but in Müller's figure the endopodites of the second pair of maxillipeds are drawn as three-jointed. His zoëa has a dorsal and frontal spine, and represents a more advanced stage than our Gelasimus embryo.

molt, after hatching, does not exhibit the strange and suggestive antennal and caudal features described by Mr. Faxon, and which he has interpreted so ably.[1]

An Abbreviated Metamorphosis in Alpheus heterochelis.—This species and *Alpheus minus* Say, are very abundant, living in the larger excurrent orifices of the large sponges which exist from the depth of one or two feet or more to deeper water, at Key West, Florida. *A. minus* is, however, far more abundant than the larger species. I found several of *A. heterochelis* with far advanced embryo, in the winter of 1869–70, and on removing the embryonic zoëa from the egg, was interested to find that the larva was of a form much more advanced than in the zoëa of other Anomoura described and figured by Fritz Müller in his suggestive work entitled "Facts for Darwin." Indeed the metamorphosis appears to be abbreviated, and the larva on hatching closely approximates the form of the adult, as in the case of the development of the lobster, the crawfish, and of *Palæmon adspersus* and *Eriphia spinifrons* (the three latter observed by Rathke). The eyes were developed on very short peduncles, being almost sessile. The embryo was near the time of hatching, though the yolk was not entirely absorbed. The two pairs of antennæ were well developed and hung down behind the large claws; the five pairs of legs were well developed, the joints distinct, and the first pair were about twice as thick as the others, the claws rather large, but not so disproportionately so as in the adult form, but as much so as in the larva in the second stage of the lobster, figured by Professor Smith. The eyes were large, but nearly sessile. The abdomen was broad and flat, spatulate at the end much as in the adult; there were five pairs of abdominal feet or swimmerets (Fig. 1 *E)*, each with an endopodite and exopodite, like those seen in the second larval stage of the lobster.

[1] It was not until the greater part of this article was written that I saw that Mr. Faxon has raised *Gelasimus pugnax* from the egg for the express purpose of examining the embryonic cuticle, and that he has figured the forked tail of the first zoëa on his second plate, figure 11, which closely resembles that of the first stage of the zoëa of Carcinus. Had I noticed that he had studied the development of Gelasimus, I should not have attempted to write out my notes, but conclude to offer the remarks in this article subject to future corrections. Mr. Faxon does not state whether Gelasimus undergoes the sub-zoëal stage of Carcinus or not, and which our observations indicate do not probably exist. We would, in passing, suggest that the term sub-zoëa be applied to the zoëa before the amnion is thrown off, as it corresponds in a degree to the fleshy-hatched larva of the grasshoppers, myriapods and other Tracheata before the amnion is exuviated.

It thus appears that *Alpheus heterochelis* hatches in a stage more advanced than the first larval stage of the lobster. Unfortunately the specimens, though carefully preserved for several years, finally got misplaced, so that it is not possible for us to give a more detailed description of the young at the time of birth.

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REASON—A PSYCHOLOGICAL DISTINCTION.

BY HARLEY BARNES.

FROM its peculiar sphere, psychology requires a very close and rigid discrimination in the use of words. A prevalent looseness in this respect is a prolific source of confusion and misunderstanding in the discussion of this and similar questions.

An article in the August NATURALIST, entitled "The Reasoning Faculty of Animals," contains a number of interesting facts showing that the lower animals have the power of "reason;" this term is defined as "the power by means of which one proposition is deduced from another, and of forming a conclusion from known premises." This is truly the faculty of reasoning—a part of the understanding—but reason, as understood by psychologists, comprehends far more than this. The classification used in the editorial on insanity in the same number, and now generally accepted, I believe, places all mental operations in three great classes: the intellect, the emotions and the will. Continuing this division according to Hickok and others, we have the powers of the intellect arranged in three very distinct groups, called the sense, the understanding and the reason. A few words of explanation will make the arrangement plain.

Sense is the name given to that operation of the intellect which forces a constant flow of perceptions upon the field of consciousness. These may be perceptions of the five (or six) senses, internal perceptions of our own feelings and emotions, or the vague creations of a wandering judgmentless fancy common to children, savages, inebriates and opium-eaters. All these perceptions flow in an unconnected, unceasing train across the mirror of consciousness, and are as momentary as the beating of sound-waves against the tympanum. This gives occasion for the second operation of the intellect, called the *understanding*, by which these separate perceptions are placed in their proper relation to each other, giving ideas of definite, distinct substances, and of their reciprocal action in cause and effect. These operations, including the higher form of abstract reasoning, involve the use of the faculties of memory, reflection, association, abstraction, etc., and the formation of logical judgments.

The processes of the understanding, working upon the perceptions of sense, weave all the facts of nature into one endless chain of effects, each dependent upon its foregoing cause. In pursuing such a train of thought there can, of course, be no departure from the real and tangible; no approach to the unconditional—to the primal cause. There can be no conception of any power above nature because the understanding considers only natural facts for which it assigns natural causes; hence there can be no rising above the things known to the manner of knowing, nor above limited time and space to the Infinite, nor above conditioned power and truth and beauty and goodness to the Absolute. All these grander conceptions, distinct from judgments of the understanding in their scope, their creation, and the principles which underlie them, are the products of *reason*, the queen of the intellectual trinity and the vivifier of intellectual activity.

The lower animals have the power of sense, their perceptive faculties being often better developed than those of man, though usually not in so great a variety. They also have the power of understanding, to a variable extent; can learn from experience, reason from cause to effect, and by association of ideas; in some cases the memory is capable of considerable development. It is freely granted by all unprejudiced thinkers, I believe, that there is a possibility for the irresponsible animals to reach the very highest attainments of the understanding, though in every instance yet recorded they fall immeasurably below them. But beyond this limit they can never go; they are a part of nature and amenable to natural laws, mentally as well as physically; to modify Hamilton's famous conclusion, "the *animal* mind can never know the unconditioned." The animal mind can discover but can never invent; it can utilize and explain, but can never originate. It can have none of those thoughts commonly ascribed to morality, no appreciation of the beautiful, no knowledge of truth, no conception of the infinite and the absolute.

EDITORS' TABLE.

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

—— We publish to-day a short critique, by Mr. Harley Barnes, on Mr. James' article on animal reason, which appeared in the August NATURALIST. This gentleman maintains the characters of reason as distinct from the understanding. He defines the former as the power of invention as distinguished from discovery. The understanding "can utilize and explain, but not originate. It can have none of those thoughts commonly ascribed to morality, no appreciation of the beautiful, no knowledge of truth, no conception of the infinite and the absolute." All these qualities are ascribed to reason. We think that if this be the definition of reason, that we can show that the latter has no existence whatever. Thus we deny that man has any conception of "absolute" and "infinite." They are words which do not represent ideas, just as the statement "twice two equals six," relates to nothing either objective or subjective. They belong to Spencer's class of "pseudideas." As to the "knowledge of truth," anything correctly known by animal or man is truth, and animals know a good deal of it. The "appreciation of the beautiful" is well developed in many animals, more, it seems to us, than in some men. "Thoughts commonly ascribed to morality" apparently exist in some animals, especially the dog; while they are feebly developed in some races of savage men. The superiority of men is to be conceded here, but if morality be an attribute of reason, then traces of this reason are discoverable among some lower animals. The powers of origination and invention here ascribed to man and to reason, as distinguished from the "understanding" of the lower animals, even when most orignal, are of doubtful existence. They consist generally of combinations of a few first principles already learned through experience or confirmed by experience. Musical composition is probably derived from rhythmical movements of certain brain elements, which are favored by feeble vitality of the parts, and which are combined by the subject in selected ways.—*C.*

—— North America, from the Sierra Nevada to the Rocky mountains, inclusive, will doubtless lead the world in the production of silver and gold for a considerable time. Although the aggregate of the precious metals, hitherto abstracted, reaches an enormous figure,[1] much more remains in the earth than has been taken out of it. Many good mines are only commencing their yield, while new ones are being discovered. Of course in a business where the profits are large, and the risks considerable, there will be numerous attempts to defraud the public. This may be done in various ways, and one of these is by so-called reports of would-be scientific experts. It is of first importance to persons desirous of investing in mining enterprises, that they should examine into the characters of the authors of these alleged "scientific" reports. In the investigation of the nature and value of mineral deposits, the most skillful specialists are liable to error, such are the difficulties of the subject. Yet there are companies who will publish statements from persons without knowledge or experience, and which are absolutely worthless, and often supremely ridiculous. Two notable examples of such publications have recently come under our notice. One of these, made to the Iowa Gulch Mining Co., on their property in Leadville, is a tissue of absurdities. Its author goes so far as to state that the strata dip at an angle of so many degrees "F" (? Fahrenheit). Another is the prospectus of "The Arizona and New Mexico Mining Co.," of which the Hon. E. Joy Morris is the alleged president. Several lists of mining claims are given, most of which are of little or no value, while the descriptive part of the "report" is confined to an enumeration of the productiveness of the mines of Mexico a century ago. The publication is flimsy in the highest degree, and no person of ordinary intelligence need be induced by it to part with any money.

Equally absurd, although with good intention, are the comprehensive denunciations of silver mining enterprises indulged in by a number of the newspapers of Philadelphia. On their side they display an ignorance of the subject equal to that of the so-called "experts" in question, and are in marked contrast to the press of New York and Boston, which are generally intelligent in their treatment of the business. As well denounce agriculture because some man could not raise potatoes on the Sahara, as repudiate silver and gold mining because some newspaper man has lost his money in a "wild cat."

[1] For the fiscal year 1879–80, the amount produced in this region was \$75,206,000; see report of Supt. of U. S. Mint.

RECENT LITERATURE.

HYATT'S GENESIS OF THE TERTIARY SPECIES OF PLANORBIS AT STEINHEIM.[1]—It sometimes occurs to the active student of biology, when wearied with the multiplicity of details, the almost endless species and varieties of the groups he may be making his specialty, to inquire what is the use of this great expenditure of time and mental effort, when the actual result of years of labor and research may be to add but one stone to the foundation of facts underlying the superstructure which others abler than he or his successors, may build up; or if he be synthetic in mental disposition, and capable of adding a well founded, sound generalization as the fruit of the years of his labors as a collector and discoverer of facts, what a slight contribution after all is his new "law" or induction to what is really needed to establish a philosophy of life! The earnest naturalist who desires to make a permanent solid contribution to his science, is animated with the wish to attempt, at least, a solution of two problems: What is life? and second, How did life originate? These problems are or should be the sources of inspiration, the goal to which all his effort tends. The first question may never be solved, though the attempt has been and always will be made; the second may be within the scope of the human intellect, and we may, with some confidence, hope for a solution which will appeal to the understanding of every candid naturalist, and ultimately command the assent of every philosophical mind.

The obvious method of inquiry in the discovery of the laws of evolution is to ascertain the effect upon organisms of nature and life about them, and the mutual relations of the organisms themselves. This is beginning at the bottom of the matter; and the attempts in this direction will in the long run, it seems to us, bring deeper-reaching, truer and more logical results, than by confining the attention alone to the secondary, more superficial study of variations and effects of natural selection. Mr. Darwin has, by his genius, industry and simple, popular mode of presentation of the doctrine of natural selection, produced a revolution in scientific thought. He has sowed the seed and prepared the way for more profound, thorough going views as to the origin of life-forms.

The work of Professor Hyatt before us, as well as his earlier papers on the origin of forms among the Ammonites, which have been noticed in the earlier volumes of this journal, are important contributions to the evolution hypothesis. These essays, together with those of Professor Cope on the origin of genera (1861), and his later papers on the law of acceleration and retardation, with the briefer, more fragmentary writings of other Ameri-

[1] *The Genesis of the Tertiary Species of Planorbis at Steinheim.* By ALPHEUS HYATT. (From the Anniversary Memoirs of the Boston Society of Natural History. Boston, published by the Society, 1880. 4to, pp. 114, with 9 plates.)

can naturalists, have resulted in a distinctive American school of evolutionists, if we may venture so to style it. Cope and Hyatt each working quite independently of the other, and in different branches of the animal kingdom, have arrived at the conclusion that species and genera may be both slowly, and sometimes suddenly produced through the action of the environment upon the animal or plant, producing a tendency to variation, after which the action of the laws of heredity, checked by natural selection, legitimately produced their results.

It is not our present purpose to make an exposition of Cope and Hyatt's views, but referring the reader to their essays and articles, to give in this review the results of Professor Hyatt's studies on the evolution of the Steinheim fossil snail-shells. These Tertiary fresh water shells occur in great abundance and variety of form and individuals in clay pits at Steinheim, near Stuttgartt. The shells lived in a Miocene pond or lake more or less shut in from any other waters. Attention was first called in 1866, in a brief paper by Dr. Hilgendorf, to the shells in these beds, and the light they threw upon the evolution theory, which led Professor Hyatt, in 1872, to collect these shells in large numbers, and to make an independent examination of them. The shells all belong to the genus Planorbis, and the numberless varieties and forms taken from the beds, appear to be lineal descendants of four varieties of a single ancestral species *(Planorbis levis)*, found in the lowermost beds deposited at the bottom of the lake. The inhabitants of these beds were not necessarily evolved through a vast period of time (as in general demanded by Darwinians) but Hyatt states that Professor Cope's researches among fishes and reptiles, his own among Ammonites, and at a later date Mivart's work on the "Genesis of Species," have all given a large amount of evidence, which tends to the conclusion "that vast periods of time are not necessarily essential to the production of new species, or even new generic or family forms."

Hyatt considers that the normal, smooth, primordial form *(Planorbis levis)* lived in neighboring Miocene lakes, and, before its migrations into the Steinheim lake, had four varieties, and subsequently reproduced these or their immediate descendants in the Steinheim lake. Four principal series were developed from these four varieties after their migration into the Steinheim lake, and while the original forms in the first series or line of descent had the closest relationship with each other, their descendants gradually diverged, until finally no hybrids connected the different series with each other. The first series culminated in variously keeled forms, and finally ending in an untwisted corkscrew-like form; the second series preserved the smooth normal form; the third series finally assumed a heavy, somewhat angular and rather large form, while the fourth series terminated in large, heavy, conical forms, the last one having a high spire very unlike

Planorbis and more like a Paludina in its general shape. It should be borne in mind that the forms belonging to the first series were connected by hybrids, and the whole series "presents to the ordinary observer a chaos of similarities and differences."

Referring our readers to the paper itself for details and illustrations, we may, without further delay and without criticising the author's mode of research, except to say that the time and patience spent upon the work, and the author's evident candor and accuracy, lead us to accept his results as sound inductions, now quote the conclusions of this elaborate memoir.

(1) The extraordinary modifications and series of shells found at Steinheim are in one way exceptional, and owe their existence to exceptional conditions.

(2) These conditions appear to be the isolation of the modified descendants of *Planorbis levis*, due to the absence of competing types, and the character of the environment.

(3) This environment was suitable for the propagation and perpetuation of the distinctive peculiarities of their series, and unfavorable in various degrees to those of the sub-series of the first series.

(4) That while the perpetuation and survival of the differential characteristics can be thus accounted for, we must look to other causes for the production of the parallel forms and the regularity of succession of these forms, as shown in the arrangement in the different series, and in the development of the individual.

(5) That this cause lies in some law of growth and heredity which reacts against the tendency of the physical environment to produce variations and differences, and produces parallelism in the development of different individuals of the same species, of different species in the same series, and in the succession of forms in the different series, and also limits the tendency to variation within definite boundaries in the species, especially in *Planorbis levis*.

(6) That while the influence of the environment must be admitted as paramount in exceptional instances, it for the most part produces these exceptions in extreme cases of parasitism, and the Steinheim shells are not parasites, and cannot be assumed to have been under similar influences in respect to the laws governing the size and genesis of the series, they ought, therefore, to come under the same laws as other forms occurring in other localities.

(7) That this appears to be the case except in so far as they are a very limited group, confined to a very limited field, a field free from competition, and extremely favorable to their growth for that and other reasons.

Professor Hyatt next inquires, "what is this law of heredity and growth which maintains the type, causes parallelisms and constrains variation under ordinary conditions, but still, in certain cases, is forced to give way to physical influences.

"Ruling out the lost or transient forms which are not perpetuated, we see that the fundamental law here, as elsewhere, is, that all the characteristics are inherited after they are once introduced.

"In former essays, especially written for this purpose, I have tried to show that there was such a general law which is so plain and simple that I have wondered that no authors have made it the basis of investigation except Professor Cope and myself. In every series of animals which I have studied, the same fact appears, namely, that in a given number of generations, inherited characteristics of every kind tend to appear in the descendants at earlier stages than that at which they first occurred in the ancestral forms. Whether characteristics are normal or abnormal, provided they are fixed in the race either by the action of natural selection or by the direct working of physical causes, they are inherited according to this law.

"The law of acceleration appears to me, at present, to show the manner in which characteristics, which are perpetuated, finally either disappear or become fixed in the young, or even in embryo. This conclusion may be followed out by any one who will arrange a series of animals or their shells, according to their adult affinities and their developmental characteristics. He will then see that adult characteristics which are introduced in ancestral forms, tend to reappear at earlier and earlier stages, as he travels along the series."

MAREY'S ANIMAL MECHANISM.[1]—Although the main principles and facts contained in this interesting volume have been already given to the public by way of abstracts in scientific journals, yet it is not too late to call the attention of zoölogists to the value of this work in their studies. Animal mechanics has been much neglected from the difficulties of the subject. The practical bearings are, however, of great importance, for if we knew under what conditions the maximum of speed, force or labor which man either singly or in armies could furnish, might be obtained, a general would know how much of a load a soldier could carry, while if we knew exactly at what pace an animal does the best work, whether he be required for speed or for drawing loads, we could all be Mr. Bergs and prevent much suffering in our noblest of animals, the horse, and that only less useful creature, the ox; while in the good time coming, when electricity may serve as the motive power instead of steam, animal mechanics will reach its apotheosis in a flying machine adapted to the wants of our everyday life, as well as of the traveler, soldier, and all whose calling may impel them to seek a means of locomotion in rapid aerial transit.

[1] *The International Scientific Series. Vol. xi. Animal Mechanism:* a Treatise on terrestrial and aerial Locomotion. By E. J. MAREY, Professor at the College of France, etc., with 117 illustrations. New York, D. Appleton & Co., 1879. 12mo, pp. 283. $1.75.

Our more immediate purpose in noticing this book, has been to call the attention of our zoölogical readers to the chapters on animal motion and electricity in animals, on the harmony between the organ and the function, involving the acceptance of the development hypothesis, and finally the excellent and suggestive chapter on the variability of the skeleton.

After discussing the origin of heat, of mechanical work, and of electricity in the animal kingdom, in order to establish clearly that these forces are the same as those which are seen in the organic world, the author proceeds to study mechanical force, and more especially to follow it through all it applications to work of different kinds which it executes in an animal. Marey adopts the old comparison between an ordinary machine and the animal, the organs of the latter corresponding to the parts of the machine, and then he insists on the strict relations existing between the form of the organs and the character of their functions; he farther maintains that this correspondence is regulated by the ordinary laws of mechanics, "so that when we see the muscular and bony structure of an animal, we may deduce from their form all the characters of the functions which they possess." He notices the fact that in the kangaroo, essentially a leaping animal, there is an enormous development of the muscles of leaping, the *glutei*, the *triceps extensor cruris*, and the gastrocnemial muscles. In birds the function of flight is exercised under very different conditions in different species; so also the pectoral muscles, which move the wings vary greatly in different birds. For example, birds which have a large surface of wing, as the eagle, gull, tern, &c., give strokes of only a slight extent; that depends on the great resistance which a wing of so large a surface meets with in the air. Those birds, however, which have small wings, as the guillemot and the pigeon, move them to a great extent. "If it be admitted that the first mentioned birds must make energetic but restricted movements, and that the second must move with less energy, but with greater amplitude of stroke, the conclusion arrived at must necessarily be that the first ought to have large and short pectoral muscles, while in the second, these muscles should be long and slender." This is proved, says Marey, by a simple inspection of the sternum in different species; "for this bone measures in some degree the length of the pectoral muscles which are lodged in its lateral cavities. Thus birds with long wings have a wide and short sternum; the others have one which is long and slender." "We might multiply," says our author, "indefinitely, examples which prove the perfect harmony between the form of the muscles and the characters of their functions. Everywhere the transverse development of these organs is associated with strength, as in the triceps of the kangaroo, or the masseters of the lion; everywhere also, the length of muscle is connected with the extent of movement, as in the examples which we have just cited." Now, inquires Marey, is this harmony preëstablished, or rather is it formed under the influence of function in different creatures? Just as we see muscles increase in volume by use, so we may observe them, under the influence of more extended movements, acquire a greater length. "Can we see a displacement of the tendinous attachments of the muscles to the skeleton, under the influence of changes in the force of muscular traction? This problem he proposes to settle by experiment, but before doing so he feels obliged to invoke the development theory, and to show that all through nature, and even in medical science, when an organism, as also an organ, is placed under new circumstances it must change in form, and that "function makes the organ." His philosophy is a substratum of Lamarckianism, *i. e.*, change in the environment ensuring change in the organ and in the organism; with a superstructure of Darwinism, or natural selection, acting after a change or variation has been induced. The application of these views is seen in chapter IX, Variability of the Skeleton, an essay of great interest from the point of view of the laws underlying the sciences of comparative anatomy and palæontology.

Professor Marey shows in this chapter how yielding in its nature is the bony system of the vertebrates during life; that pressure or tension, however slight, will produce the strangest changes of form; the bone, he goes so far to say, is "like soft wax which yields to all external forces," and we may say of the skeleton, that "its form is that which the soft parts with which it is surrounded permit it to assume." He cites cases in surgery and medicine, as well as comparative anatomy, in proof of the proposition "that in the form of the bony structure, everything bears the trace of some external influence, and particularly of the function of the muscles. There is not a single depression or projection in the skeleton, the cause of which cannot be found in an external force, which has acted on the bony matter, either to indent it, or draw it forward."

The great variety of forms in the skeletons of different animals corresponds with the diversity of their muscular systems. Now if the muscles modify the bones, what brings about the various changes in form of the muscles? Marey attempts to demonstrate that the power to which the muscular system is subjected belongs to the nervous system. "The nature of the acts which the will commands the muscles to perform, modifies the muscles themselves, in their volume and their form, so as to render them capable of performing these acts in the best possible manner." The author, from facts in medicine and surgery, shows that it is movement or use which maintains the existence of the muscle; after paralysis or dislocation of bones rendering muscles useless, a muscle may wholly disappear, undergoing either fatty degeneration or fibrous transformation.

With these principles in view, and guided by them, our author then discusses with great originality, and chiefly by the experimental method, locomotion in general, that of man and the horse, and finally the flight of insects and of birds.

PEIRCE'S IDEALITY IN THE PHYSICAL SCIENCES.[1]—It is commonly said by pulpit orators and metaphysicians of the transcendental school, that physical science is lowering and materialistic, that it is concerned with facts alone, and physical, material laws, and that its study tends to deaden the finer sensibilities of the mind and to weaken the grasp of the intellect. How incorrect such a notion is, every thinking scientist realizes; his mind, observant of facts in nature, is continually on the alert, endeavoring to ascertain the meaning of those facts; he is constantly rising from the seen to the unseen; from the actual to the ideal. The late Professor Peirce, whose life was devoted to the study of mathematics, to dry computations carried on year after year, in these posthumous lectures, tells us in impassioned, eloquent words, which every scientist should read, that facts organized into theory "ascend to the very throne of ideality." And if the highest researches of the mathematician are especially transcendental, how much more ideal and transcendental, we would add, become the researches of the biologist, who is concerned with the elusive and subtle laws of life and the mental and spiritual forces of man. No wonder, for example, that the thinking world is profoundly moved by the ideas suggested by evolutionists, and by the study of the origin of things material, for these problems touch upon the deepest, most insoluble problems of man's nature.

The general student of geology and biology will also read this fascinating volume for the sake of the author's views regarding the nebular hypothesis and general cosmogony. Professor Peirce may be regarded as one of the founders of the nebular hypothesis in its modern form. In this book he guides us through the successive steps in nebular history—from chaos to nebula, from nebula to star, and from star to planet.

The author in beginning his exposition of the nebular hypothesis, regards the first chapter of Genesis, rightly interpreted, as "a profound cosmogony. It may not be the revelation of an actual fact, but it teaches where that revelation is to be found; that it is engraved on stone by the all-wise Author; that it is written in the sun, moon and planets; that it is inscribed on the sidereal universe, and that every star is an oracle of God." Coming to the nebular theory, the author treats of nebulosity, of a nebula proper, a cluster, the Milky Way, the Magellanic cloud, of an annular nebula and a spiral nebula; then of the star, and finally the planet, comet and meteor. Geologists will be interested in this philosopher's views as to the cooling of the earth and the

[1] *Ideality in the Physical Sciences.* By BENJAMIN PEIRCE. Boston, Little, Brown & Co., 1881, 12mo, pp. 211.

sun. After a discussion of Thompson's views upon the cooling of the earth, the author gives his reasons for not accepting his explanation of the process of solidification, with its corresponding limitation of the geological ages. Peirce believed that there was a permanent superficial solidification at an exceedingly early stage of the process, together with the formation of an interior solid nucleus. "These interior and exterior solid portions will be separated by a liquid stratum, which is ever decreasing in thickness, to supply the increasing solidity above and below it." Hence the larger portion of the earth's interior being liquid, the earth must have become solid in a vastly greater length of time than Thompson supposes, "and no physical obstacle can mathematically be interposed to embarrass the researches of geologists, to interfere with their ages of erosion, and to diminish the possibility of an increased duration of organic life."

Turning then to the current view that the sun is not more than 20,000,000 years old, our author believed that by computation the age of the sun may have been twenty-five times greater than the estimates of some distinguished astronomers and physicists.

The concluding chapter on potentiality is replete with suggestions by a Christian philosopher for arguments for the existence of a Creator and the immortality of the soul; and the volume is well worth reading, not only for the invaluable exposition of the nebular hypothesis, but as a proof that the legitimate results of speculative evolutionary science tends to demonstrate the existence, outside of the material world, of a Creator and of a spiritual world, where the soul of man, "whose only life is action," freed of its physical scaffolding, however important in the beginning, may hereafter engage in ceaseless intellectual as well as spiritual activities.

New England Bird Life.[1]—There has never been published anything like a complete exhibition of New England bird-life. Samuels' work,[2] the first attempt at it, was very successful as a popular ornithology, but was hardly worthy of its success; while Minot's later volume,[3] meant for a substitute, was incomplete, designedly omitting all the water-birds, and seemed to many wanting in precision and authority. The last work, just published (its title is given below), is by Mr. Winfrid A. Stearns, son of the late President of Amherst College. It should be welcomed as a concise, clear and careful summary of our knowledge of New England birds. In freshness, and individuality, and fullness it may seem wanting, though not in occasional picturesqueness. As a di-

[1] *New England Bird Life, a Manual of New England Ornithology*. By Winfrid A. Stearns. Revised and edited by Dr. Elliott Coues. Published by Lee & Shepard of Boston, and Charles T. Dillingham of New York. Part I. Oscines (1881): pp. 324, illustrated. $2.50.

[2] "Ornithology and Oölogy of New England." By Edward A. Samuels. (1867.)

[3] "Land-birds and Game-birds of New England. By H. D. Minot. (1876–77.)

gest and a manual it has no equal. How much of its value is due to its very able editor, does not appear. His interpolations, however, are too often personal rather than ornithological. The physical features of the volume are all satisfactory, except the numerous illustrations, all borrowed, and many of them too old for further use. The contents are: an introduction, with suitable information on structure, and on the preparation of specimens, and with very satisfactory presentation of faunal areas and of special bibliography; next, somewhat brief descriptions of the birds and of their lives, all systematically arranged; and finally, two *indices*. The copious references to particulars of evidence, are an admirable characteristic. The present part includes the song-birds only (technically, *Oscines*). A continuation and completion, in a second volume, is promised by the publishers. Our hopes, so often disappointed, of a good popular work on our water-birds, are again animated. Why cannot Mr. Stearns fulfill them, with additional credit to himself, and pleasure to the public?—*H. D. M.*

Bronn's Classes and Orders of the Animal Kingdom, Crustacea.—Geistaecker's great work on the Crustacea has reached the first three numbers of the second part, on the Malacostraca, and begins with the Isopods, treating of them in the same general manner as the Entomostraca and other lower Crustacea. Some ninety pages are devoted to an account of the organization of this group, the subject not being completed at the end of the third number. The eight closely crowded plates are well drawn. When this series is completed it will form a library in itself.

Index to Riley's nine Reports on the Insects of Missouri.[1]—The nine reports of Professor Riley on the injurious insects of Missouri, were perhaps the most valuable series of State entomological reports ever issued, consisting largely of original matter with most excellent illustrations; and as they have long been out of print, this index and supplement will be useful for reference, as all of the descriptions of new species are reproduced with notes and additions.

Recent Books and Pamphlets.—On the Cynipodous galls of Florida. By William H. Ashmead. From the Monthly Proceedings Entomological Section Academy Natural Sciences Philadelphia, 1881. Paper No. 1, pp. IX–XIV; Paper No. 2, pp. XV–XX. From the author.

On the number of molts of butterflies, with some history of the moth Callosamia promethea. By William H. Edwards. From Psyche, Vol. 3, No. 81, pp. 159–161. From the author.

Annual Report of the Entomological Society of the Province of Ontario for the year 1880. Toronto, 1881, 8vo, pp. 89. From the society.

Note sur deux Sociétés d'horticulture aux Etats-Unis. Par M. V.-Ch. Joly. From Journal de la Soc. nation. d'Hortic., 3e série, III, 1881, p. 261–271. From the author.

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[1] *Department of the Interior, U. S. Entomological Commission.* Bulletin No. 6. General Index and Supplement to the nine reports on the Insects of Missouri. By Charles V. Riley. Washington, March 24, 1881. 8vo, pp. 177.

Berliner Entomologische Zeitschrift. Herausgegeben von dem Entomologischen Verein in Berlin. 25ter Band (1881), erstes Heft. From the society.

Some characters useful in the study of the Sphecidæ. By W. H. Patton. From the Proceedings Boston Society Natural History, Vol. XX, January 21, 1880, pp. 378–385. From the author.

List of the North American Larridæ. By W. H. Patton. L. c. pp. 385–397. From the author.

Notes on the Philanthinæ. By W. H. Patton. L. c. pp. 397–405. From the author.

Synopsis of the Lampyridæ of the United States. By John L. LeConte, M.D. From the Transactions American Entomological Society, Vol. IX, 1881, pp. 15–72. From the author.

On Pieris bryoniæ Ochsenheimer, and its derivative forms in Europe and America. By W. H. Edwards. From Papilio, Vol. I, No. 6, pp. 83–99. From the author.

Revision of the species of Polyphylla of the United States. By George H. Horn, M.D. From Trans. Am. Entom. Soc., Vol. IX, 1881, pp. 73–76, From the author.

Notes on Elateridæ, Cebrionidæ, Rhipiceridæ and Dascyllidæ. By George H. Horn, M.D. From Trans. Am. Entom. Soc., Vol. IX, 1881, pp. 76–90, tables I and II. From the author.

Geological Survey of Alabama. Reports of Progress for 1879 and 1880. By Eugene A. Smith, Ph.D., State Geologist. 8vo, pp. 158. Montgomery, Ala., 1881. From the author.

Catalogue of the Phænogamous and Vascular Cryptogamous Plants of Michigan, Indigenous, Naturalized and Adventive. By Charles F. Wheeler and Erwin F. Smith. Lansing, 1881. 8vo, pp. 105. From Erwin F. Smith.

Description of the preparatory stages of Papilio palamedes Drury (calchas Fab.). By W. H. Edwards. From Can. Entom., Vol. XIII, No. 6, pp. 119–123. From the author.

Effect of cold applied to chrysalids of Limenitis disippus. By William H. Edwards. From Psyche, Vol. III. No. 82, p. 174. From the author.

Agricultural advancement in the United States. By C. V. Riley, M.A., Ph.D. An address read at the organization of the American Agricultural Association. From the author.

Descriptions of some new Tortricidæ, by C. V. Riley, M.A., Ph.D. Trans. St. Louis Ac. of Sc., Vol, IV., No. 2, April 28, 1881.

Beiträge zur Paläontologie von Osterreich-Ungarn und den Angrenzenden Gebieten (V. Uhlig. Die Jurabildungen in der Umgebung von Brünn. Zweite Abtheilung mit Taf. XVI–XVII. Alois v. Alth. Die Versteinerungen des Nizniower Kalksteines. Erste Abtheilung mit Tafel XVIII–XXI. Herausgegeben von E. v. Mojsisovics und M. Neumayr. Ausgegeben am 20 Juli, 1881. 4to, pp. 68, 7 plates. Wien, 1881. From the editor.

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Dr. H. G. Bronn's Klassen und Ordnungen des Thier-Reichs, Wissenschaftlich dargestellt in Wort und Bild. Fortgesetzt von C. K. Hoffmann, Doctor der Medicin und Philosophie, Professor in Leiden. Mit auf Stein gezeichneten Abbildungen. Sechster Band. III Abtheilung. Reptilien 18, 19, 20 und 21, Lieferung. Roy. 8vo, pp. 127, 8 plates. Leipzig und Heidelberg, 1881. From the editor.

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Sur l'Arc Pelvien chez des Dinosauriens de Bernissart. Par M. G.-A. Boulenger. Rapport de M. P.-J. Van Beneden. 8vo, pp. 8. Brussels, 1881. From the author.

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Códice Meneazino; Ensayo de descifracion georgifica. Por el Sr. D. Manuel Orozcay Berra. (Continuacion.)

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A Blastoid found in the Devonian Rocks of Ontario. By Henry Montgomery. 8vo, pp. 4, cuts. Extract from the Canadian Naturalist, Vol. X, No. 2. Montreal, 1881. From the author.

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GENERAL NOTES.

BOTANY.[1]

CARUEL'S NEW SYSTEM OF PLANTS.—In the last number of his *Giornale Botanico Italiano*, Caruel proposes a system of plants which contains so many interesting points that it will be profitable to reproduce it here in a condensed form. He recognizes five grand divisions, viz: Gymnogamæ, Bryogamæ, Schistogamæ,

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

Prothallogamæ and Phanerogamæ. The first is equivalent to the Thallophyta of many German botanists, but is treated very differently by the author. The Myxomycetes are very properly placed at the lower end of the division, in a separate class, the Plasmodieæ. In accordance with the rapidly growing idea first brought out by Cohn, the chlorophyll-bearing and chlorophyll free plants are not separated as Algæ and Fungi; and the lichens are considered an order constituting with the Sphærideæ and Gymnoascideæ the cohort Angiosporatæ, the latter very nearly equivalent to the Ascomycetes of botanists. The radical error, as it appears to us, in Caruel's disposition of the plants of the class Thallodeæ consists in making use of the asexual reproductive bodies in characterizing the sub-classes. Conidia and zoöspores at least, and almost certainly the tetraspores also (chains of four conidia?), are homologues, whose differences are related to differences in the habitat of the plants producing them. Conidia (if we except tetraspores) are aerial, while proper zoöspores are aquatic.

The position assigned to the Characeæ is scarcely a tenable one. They are too nearly related to the Floridiæ, and too distantly to the ferns to warrant placing them between the Bryogamæ and Prothallogamæ.

The separation of the Phanerogamæ into three classes will strike every one as an innovation of doubtful value. Why the orthography of Gymnospermæ should be changed to Gynospermæ, is also to be questioned. It will be observed that the cohorts and orders of the Angiospermæ rank higher respectively than do the groups bearing these names in the system most in vogue in this country: the families (omitted for want of space) in Caruel's system, are almost the equivalents of the orders of Bentham and Hooker, while Caruel's orders are nearly equivalent to Bentham and Hooker's cohorts.

Division GYMNOGAMÆ.

Class PLASMODIEÆ.

Cohort *Plasmodiatæ.*

Order Myxomycetes; Fam. Ceratiaceæ, Trichiaceæ.

Class THALLODEÆ.

Sub-class SCHIZOSPOROPHORÆ.

Cohort *Schizosporatæ.*

Order Nostochideæ; Fam. Chroococcaceæ, Oscillariaceæ, Nostocaceæ, Rivulariaceæ, Scytonemaceæ.

Sub-class CONIDIOPHORÆ.

Cohort *Gymnosporatæ.*

Order Puccinideæ; Fam. Sporotrichaceæ, Fusariaceæ, Stilbaceæ, Trichodermaceæ, Ustilaginaceæ, Pucciniaceæ.

Order Agaricideæ; Fam. Exobasidiaceæ, Tremellaceæ, Agaricaceæ, Lycoperdonaceæ.

Cohort *Angiosporatæ.*

Order Gymnoascideæ; Fam. Gymnoascaceæ.

Order Sphærideæ; Fam. Helvellaceæ, Sphæriaceæ, Erysiphaceæ, Tuberaceæ.

Order Lichenideæ; Fam. Myriangiaceæ, Verrucariaceæ, Parmeliaceæ.

Sub-class ZOOSPOROPHORÆ.

Cohort *Euzoosporatæ.*

Order Ulvideæ; Fam. Cladophoraceæ, Ulvaceæ, Sphacelariaceæ, Sporochnaceæ.

Cohort *Zygosporatæ.*

Order Pandorinideæ; Fam. Botrydiaceæ, Pandorinaceæ, Ulotrichaceæ.

Order Zygnemideæ; Fam. Diatomaceæ, Desmidiaceæ, Zygnemaceæ.

Order Peronosporideæ; Fam. Mucoraceæ, Chytridiaceæ, Peronosporaceæ, Saprolegniaceæ.

Cohort *Oosporatæ.*

Order Vaucherideæ; Fam. Monoblepharidaceæ, Volvocaceæ, Vaucheriaceæ, Sphæropleaceæ, Œdogoniaceæ, Coleochætaceæ.

Order Fucideæ; Fam. Ectocarpaceæ, Fucaceæ.

Sub-class TETRASPOROPHORÆ.

Cohort *Tetrasporatæ.*

Order Pseudofloridеæ; Fam. Porphyraceæ, Dictyotaceæ.

Order Florideæ; Fam. Ceramiaceæ, Nemaliaceæ, Lemaneaceæ, Sphærococcaceæ, Melobesiaceæ, Rhodomelaceæ.

Division BRYOGAMÆ.

Class MUSCINEÆ.

Cohort *Muscineæ.*

Order Hepaticæ; Fam. Anthocerotaceæ, Ricciaceæ, Targioniaceæ, Monocleaceæ, Marchantiaceæ, Jungermanniaceæ.

Order Musci; Fam. Andreæaceæ, Phascaceæ, Sphagnaceæ, Bryaceæ.

Division SCHISTOGAMÆ.

Class PUTERÆ.

Cohort *Puteræ.*

Order Puteræ; Fam. Characeæ.

Division PROTHALLOGAMÆ.

Class ISOSPOREÆ.

Cohort *Isosporeæ.*

Order Filicariæ; (1) Sub-order Trichosporangiæ; Fam. Hymenophyllaceæ, Polypodiaceæ, Gleicheniaceæ, Osmundaceæ.

(2) Sub-order Phyllosporangiæ; Fam. Marattiaceæ.

(3) Sub-order Ophiosporangiæ; Fam. Ophioglossaceæ.

Order Calamariæ; Fam. Equisetaceæ.

Order Conariæ; Fam. Lycopodiaceæ.

Class HETEROSPOREÆ.

Cohort *Heterosporeæ.*

Order Phyllocarpariæ; Fam. Selaginaceæ, Isoetaceæ.

Order Rhizocarpariæ; Fam. Salviniaceæ, Marsiliaceæ.

Division PHANEROGAMÆ.

Class GYNOSPERMÆ.

Cohort *Coniferæ.*

Order Strobilifloræ; Fam. Cycadaceæ, Pinaceæ, Taxaceæ, Gnetaceæ.

Order Conifloræ; Fam. Welwitschiaceæ.

Class ANTHOSPERMÆ.

Cohort *Dendroicæ.*

Order Spermifloræ; Fam. Viscaceæ, Loranthaceæ.

Class ANGIOSPERMÆ.

Sub-class DICOTYLEDONES.

Cohort *Dimorphanthæ.*

Orders Julifloræ, Globifloræ, Clavifloræ, Urticifloræ, Euphorbifloræ, Begonifloræ.

Cohort *Monochlamydanthæ.*

Orders Nudifloræ, Involucrifloræ, Ranifloræ, Cactifloræ, Cytinifloræ, Daphnifloræ.

Cohort *Dichlamydanthæ.*

Orders Cirrifloræ, Myrtifloræ, Lythrifloræ, Rosifloræ, Tiliifloræ, Crucifloræ, Rutifloræ, Ericifloræ, Primulifloræ, Celastrifloræ, Umbellifloræ, Oleifloræ, Campanifloræ, Asterifloræ, Corollifloræ.

Sub-class MONOCOTYLEDONES.

Cohort *Centranthæ.*

Order Centrifloræ.

Cohort *Hydranthæ.*

Orders Fluviifloræ, Alismifloræ.

Cohort *Lirianthæ.*

Orders Glumifloræ, Spadicifloræ, Liliifloræ, Labellifloræ.

INFLUENCE OF SEVERE WINTERS ON VEGETATION.—The Botanical Society of France had its annual gathering at Fontainebleau this year, in the end of June. Among other matters that came up for study (we learn from *Revue des Deux Mondes)* was the modification of the flora of that district in recent times. A number of species have disappeared, chiefly by reason of severe winters. The winters of 1564, 1709, 1788 and 1879–80 were disastrous. Recent meteorology has proved that elevated places generally suffer less from cold than those of low position. The trees on low ground at Fontainebleau have suffered peculiarly. Cereals have suffered more on high ground, because snow is their best defence against frost, and on exposed points it is more driven about by wind. Many herbaceous plants, too, have been protected by snow, but several which grew on walls or the face of rocks have succumbed. Evergreens have suffered more than others, and the general destruction of the maritime pine in the central parts of France (in Champagne, Garthe, Rambouillet, as well as at Fontainebleau, it has perished), is a grave loss to the country. Among other plants which have been frozen out, or nearly so, in the center of France, are the broom heather, holly, ivy and box. Among species with caducous leaves, the elder, and even the oak, have seriously suffered; and the loss of chestnuts and walnuts, which used to be largely cultivated in the valley of the Loir and in Touraine, have thrown idle for a long time the oil-mills of that part of France. The Fontainebleau flora has been enriched, in recent times, with various new species, as well as impoverished by disappearance of old ones.—*English Mechanic.*

BOTANICAL NOTES.—Professor Goodale, of Harvard University, sails for Germany soon, to remain a year.——Dr. Gray intends to return from his sojourn in Europe early in the autumn.——The Cincinnati meeting of the American Association for the Advancement of Science did not yield much in the way of botanical papers. A half dozen papers, some scarcely passable, constituted the whole contribution from the botanists of the Association. What are our botanists doing? Doubtless they are busy; but it is not creditable to American science that so few papers were presented by them, especially when we bear in mind the length of the list of American botanists. A movement is under way to make a better showing in botany at the Montreal meeting.——One of the best botanical papers presented at Cincinnati was by Dr. Beal on the "Movements of Roots in germinating Indian Corn." Darwin's statement that "in whatever direction the primary radicle first protrudes from the seed, geotropism guides it perpendicularly downwards," was shown to require modification. Over four hundred kernels of sprouted Indian corn were placed over a large pan of water and set in the dark. No gummed papers were placed on the radicle-tips of these, yet they took many different directions. In all the lots, one coil or more was a very common thing; some coiling over and some under. Many went downwards, some in nearly a horizontal position, several directly upward where two of them made three coils each. No roots were tested in soil. An abstract cannot do this paper justice, since it was much condensed as it was presented. The results were quite remarkable. At another time some seeds were sprouted over water in the dark. Small pieces of gum paper placed a trifle one side of the tip, usually caused the root to bend away to a marked degree, sometimes only a trifle, and sometimes it produced no effect.——Professor Penhallow's paper on the "Phenomena of Growth in Plants," dealt with the movements of the stem and tendrils of the Mammoth squash.——Professor Meehan contributed "Additional facts on the Fertilization of Yucca." By artificial self-fertilization of pistils of *Yucca angustifolia*, fruit was obtained, although the pollen was applied to the *external* lobes of the stigma.——The August number of the *American Monthly Microscopical Journal* contains half a dozen formulæ for preservative media for use in mounting microscopical preparations of vegetable tissues.——Rand, McNally & Co., of Chicago, have just issued "The American Encyclopædia of Agriculture," by Jonathan Periam. An examination of the botanical part of the work shows that unusual care has been taken in its preparation.

ZOÖLOGY.

Recent Zoological Work in France.—Among the most important zoölogical memoirs published in France, are those to be found in Lacaze-Duthier's Archives de Zoologie expérimentale et générale. The eighth volume, for 1879–'80, contains an elaborate essay, with most excellent plates, some of them printed on stone in colors, by L. C. Cosmorici, on the anatomy of the polychete Annelids. This is followed by a similar paper on a leech *(Batracobdella latastii)*, by Dr. C. Viguier, which is succeeded by an abstract of Professor W. K. Brooks' essay on the development of Lingula, a compliment to American science. Then follows a valuable essay on the existence of the *saiga* in France in the Quaternary epoch, by Professor A. Gaudry. The reproduction of sponges by external budding is discussed by C. de Merejkowsky. This subject has heretofore been treated only in a fragmentary way. It is known to take place only in one family (Suberitidinæ, in the genera Suberites, Tetilla, Tethya and Rinalda). The buds are always produced under the form of an expansion at the extremity of a stem or peduncle which arises from the surface of the body of the sponge. The peduncle supporting the bud or enlargement, is always solid and composed of spicules and of the syncytium without canal and without pores; while the bud itself is produced by the syncytium alone and its spicules, without any participation by the entoderm; and its cavities, at first entirely wanting, are formed independently of the maternal cavity. In an abstract of the author's views as to the morphology of the sponges and hydroids, he believes that the hydroid as well as the sponge, is the product of the multiplication of this primitive individual, but while the hydroid is a polymorphous colony composed of completely distinct and separate individuals, regularly disposed in a determinate order, the sponge is formed of a colony of individuals irregularly dispersed, without any arrangement, and forming a single compact mass. In his researches on the histology and development of Campanularia, M. J. Fraipont makes a valuable contribution to the literature of the history of the origin of the genital glands in this hydroid.

The Monera of Central Russia are described by A. Korotnoff, who has rediscovered Haeckel's *Protamœba primordialis*, which he regards as occupying the lowest place in the class of Rhizopodes. Other Amœboid forms are described, as well as the development of Pelomyxa, to which a plate is devoted. Professor Patrick Geddes publishes in these archives his observations on the perivisceral fluid of the sea urchin and the corpuscles contained in this fluid. The viviparity of *Helix studieriana* engages the attention of Professor Viguier, while the last paper of the volume is by the editor, on *Laura geradiæ*, elsewhere noticed in this journal.

Evolution and Hybridism in Ornithology.—In a review in *Nature*, of the British Museum Catalogue of Birds, volume fifth, containing the family *Turdidæ*, by Henry Seebohm, it is stated that one great feature of the work is the courage which the author has shown in applying the doctrine of the evolution of species to the birds as they exist at the present day. The great risk that the reviewer sees in Mr. Seebohm's method lies in the fact that it affords too easy a solution for otherwise difficult problems, but we must remember that the author was himself witness to the inter-breeding of the carrion crow and the hooded crow in Siberia, and it is known that this also takes place in certain parts of Great Britain. Having seen this with his own eyes, and brought back to England a large series of the hybrids, it was only reasonable for him to suppose that other birds are also capable of hybridizing, and the reviewer thinks that the author proves his case with regard to the two blue rock thrushes (*Monticola cyanus* and *M. solitarius*), which in certain parts of China interbreed; and it is most curious that the vast majority of the birds found in the winter quarters of the Eastern blue rock thrush, from Burmah and Malaisia to the Mollucca islands, appear to be hybrids. According to the author, *Cettia cantans* and *C. minuta* also interbreed, and produce an intermediate form which he calls *Cettia cantans minuta*, a reintroduction of trinomial nomenclature which the reviewer does not at all like. The intermediate form, too, appears to be principally found in the Island of Formosa, though also met with at Chefoo, on the mainland opposite Japan, while one of the other forms is an inhabitant of Japan, with the exception of one Formosan skin in the author's collection, and the other is said to breed in South China and Hainan. Of these three forms, then, we should suppose that the Formosan was the oldest bird from which the other two had developed themselves, but that they had not as yet become entirely separated as distinct species. We must wait for more evidence with regard to the South African chats, to some of which Mr. Seebohm has applied his principle of hybridization, as the reviewer is not yet satisfied that the changes of plumage cannot be accounted for by the more natural process due to age or the season of the year.

Breeding Habits of the Fish Hawk.—On the 28th of April I visited, in the southern part of Rhode Island, what could be called a colony of these birds, for from my position at a nest in the top of a buttonwood tree, I could count no less than twelve of their massive structures, all in a radius of half a mile. In one tree I saw what appeared to be two nests, but on closer examination found that a nest had fallen and lodged in the lower branches, the birds using the old site for a new home.

As one approaches their nest the bird stands up, whistling a shrill peep, on coming nearer it rises, and after a circle or two sometimes re-alights, inspects its eggs, and if the intruder does not withdraw, the cries of distress bring the male, after which both birds circle over the nest, the male higher and showing less anxiety than the female.

In one case, on ascending to the nest of an old pair, I was attacked by the birds and forced to descend; but I think it is seldom that they manifest so much courage. The bird at other times is extremely cowardly, allowing crows to chase it, and once I saw a crow blackbird, whether *Quiscalus versicolor* or *æneus*, I do not know, that had its nest in the basement of a fish hawk's, attack and drive its host from home.

The nests of the fish hawks were by no means shabby. The sticks, of which they were composed, were short and crooked and so firmly held together by turf and eelgrass, that it was a difficult undertaking to obtain the eggs by tunneling from the bottom. The top is very shallow; in the nests that I examined it was not more than two inches deep, but averaging fifty-four inches in diameter. I noticed that the female sits during the day for a long period before the eggs are laid; more than two weeks in one case. During the night she leaves the nest and roosts on a neighboring limb, where she is very indifferent to all about her, even allowing a person to throw stones at her without flying off. If the nest be disturbed during the night, when there are young or eggs, the bird flies off only uttering a few cries, and does not return while its nest is being robbed.

I examined more than twenty trees in which nests were placed, and found them all alive, but in a few cases the limb on which the nest was placed, was dead.—*H. C. Bumpus.*

BLACKBIRDS CATCHING FISH.—A mill-dam is in process of repair near my residence, on Boone river. Visiting the spot to-day, I was much amused to see some crow blackbirds catching minnows! At one end of the dam the water was forcing its way through in a small stream which ran with great rapidity, from the descent as well as from the pressure above. This little stream spread out over some loose boulders in a sort of fan-shape, being generally not more than one inch deep. Up this steep place myriads of minnows, two to three inches in length, were trying to force their way. Many of them were unable to stem the current and were swept down stream. In this swift, shallow water, three or four crow blackbirds (doubtless *Quiscalus æneus* Ridgway) were wading about, keen and alert, every moment or two picking up and swallowing a minnow. They appeared to understand their business to perfection, and made no mistakes—seeming to get one of the little fishes every time they made the attempt. I have often seen these birds wading in the shallow water along the margin of the stream, but this is the first instance in which I have seen them capture fish. They are very tame, making themselves entirely "at home" in our barnyards and fields. The groves along our little river are their favorite nesting-places. There used to be some complaint in regard to their raids upon cornfields just as the young blades were a couple of inches high, but I have heard nothing of the kind in recent years.—*Charles Aldrich, Webster City, Iowa, May 11, 1881.*

HABITS OF THE ROCKY MOUNTAIN AXOLOTL.—Mr. W. E. Carlin, in an article in the Proceedings of the U. S. National Museum, on *Siredon lichenoides*, the larva of Amblystoma, observed by him in Lake Como, Wyoming Territory, states that they never enter the stream of fresh water, preferring the alkali water of the lake. The change from alkali to fresh water undoubtedly hastens the metamorphosis into the Amblystoma form. "In two cases the change in external appearance was so abrupt that I would have been almost certain that another salamander had been substituted for the one in the jar, had I not had him so completely under observation that it was impossible. The gills had assumed a stubby form about half the length that they were the night before, and the gill on the back of the body was nearly half gone; it took air quite often, and I removed it from the jar and placed it in a box with some lake grass around it to keep it moist. It completed the metamorphosis in a few days. I did not feed it any during this time. While it was in the jar it was well fed with flies." Mr. Carlin found that the axolotl late in July and during August, leaves the lake in large numbers on rainy days and transform. "While catching Siredon, I have seen and caught a number of Amblystoma in the lake, with the metamorphosis, as far as I could see, as complete as those we find half a mile from the lake. They cover the ground by thousands during a warm summer rain, coming from every conceivable place where they could have found shelter, from under rocks, boards, old ties, and out of gopher holes. I have a cat that eats them greedily, and I am told by a resident that the numerous skunks that live around the lake live principally on them." After the first frost they completely disappear.

Systematic Position of Balanoglossus.—Elias Metschnikoff has returned to the view which he expressed twelve years ago with regard to the close affinity between this curious "worm" and the Echinoderms. The larvæ of the two types are identical, since the differences insisted on by A. Agassiz as regards the water-vascular system have been shown by Goette to be erroneous. Metschnikoff claims that the water-vascular system, which is so eminently characteristic of the Echinoderms, is represented in Balanoglossus by the proboscis-sac, which he regards as a single, conical, ambulacral tentacle, and it should be borne in mind that in Synapta, which is a genuine Holothurian, not only the ambulacral cœcal sacs, but also the longitudinal trunks are lost. The peritoneal system would also seem to be represented in Balanoglossus, and is lined by just the kind of membrane as in the Holothurians, while the circulatory system in these Echinoderms is very similar to that of Balanoglossus. He regards the gills as rudimentary water-vessels delayed in development and undergoing vegetative repetition. The absence of calcareous matter from the integument of the worm is a notable point of difference, but on the other hand the nervous system is very similar. The author therefore proposes to form the type *Ambulacraria*, with the two sub-types of *Radiata* and *Bilateralia*, the type of the latter group being Balanoglossus.

Unusual Actions of a Hen Turkey.—While visiting in the southern part of Indiana, this spring, my attention was called to the strange proceedings of a young hen turkey. She was on her first "setting" of eggs, and was doing her best apparently, but nothing came of it. For two months she kept her place steadily and at the end of that time an attempt was made to break up the nest. It was found there were but two eggs left of the seven she began with. It was a complete disappearance, not even a trace of the five missing eggs being left. The next day an egg was accidentally discovered in a woody pasture, a quarter of a mile from the nest, having been apparently dropped there. It was very light, being almost empty. On the following day, while half a dozen of the family were sitting under the trees within twenty yards of the nest, the turkey rose, flying high over the house and off towards the pasture, and in her mouth was an egg. A visit to the nest showed but one egg left. In a short time the hen came walking back and took her place on the nest. It was evident that six eggs had been carried off in this way at different times and dropped in different places. Whether this proceeding showed a feeling of disgust on the part of the turkey, or was merely an instinctive clearing of the nest, I cannot say.—*John M. Coulter.*

Change of Color in Crabs and Prawns.—Dr. Fritz Müller contributes some instances of this phenomenon—already discovered by Kröyer—from the Brazilian fauna. A shrimp *(Atycida potimirim)* has a female which, when adult and living among water-plants, is usually dark green, sometimes inclined to blue or brown, occasionally of a pure blue with a pale brown streak down the back; when put into a glass vessel it fades to an increasingly pale brown, which disappears and leaves the animal colorless and transparent in the course of a few days; a dark brown specimen placed with a number of others which had the usual greenish hue assumed their color in a few minutes. A black Palæmon taken from deep water became first dark, then pale blue, and the color, losing its even distribution, became accumulated in many closely-packed patches; after half a day from the time of capture it had lost all color, with the exception of the caudal swimmeret, which remained blue. The male of a small land crab (Gelasimus), whose carapace is marked with pure white and light green, loses these colors when captured, and they are replaced by a uniform gray.—*Journal of the Royal Microscopical Society.*

The Blue Gull.—During some of our wet seasons a little blue gull stays with us all through the summer. I believe they always come here in the spring, but if the water dries out of the ponds and sloughs, they do not remain—probably retiring to the lakes, where open water is always to be found in warm weather. They are quite tame, flying often very close to men and teams. They seldom alight upon the ground, and it is a popular notion that they are never seen except on the wing. I have, however, occasionally seen them sitting upon the muskrat ponds out in the sloughs. They often follow a plowman, greedily devouring the worms and bugs which are turned up to the surface. Fluttering down very gracefully, they pick up their game without setting a foot upon the ground! In this manner they requently follow the plow for hours, so intent upon their work that they might easily be killed with a blow from the plowman's whip.—*Charles Aldrich, Webster City, Iowa, May 11, 1881.*

Male Crustacea producing Eggs.—In the course of his studies on the Amphipods of the Adriatic, Herr Neteski found that eggs are developed in the testes of the males. These organs are in the form of simple tubes, consisting of a germ-gland and an efferent portion. Only the hinder half of the tubes produce male products, the anterior quite constantly developing eggs, but for these there is no special duct. The egg-producing portion has much the same microscopic structure as that in which the spermatozoa are developed, and the rudimentary eggs are only distinguished from the spermatoblasts by developing into eggs. The eggs developed in the male differ from those of the female in the structure of their protoplasm, for the yolk-spheres are not in them so distinctly developed, and it would appear that they never become fully matured. This remarkable phenomenon has not, therefore, any physiological significance, and in structure the organ is truly a testis. The author reminds us that Phalangium stands in a similar condition.

Animal Pests in Greenwood Cemetery.—The New York *Sun*, citing the report of the trustees of Greenwood Cemetery for 1880, says: "It is noted that chipmunks made their appearance in the cemetery during the last year for the first time. The injury done by them has been deemed a sufficient cause for their extermination, and 2853 of them were killed. Ground mice to the number of 375, 148 cats, 40 dogs, 133 snakes, 24 moles and 54 rats have also been killed.

Zoölogical Notes.—A nervous system has been discovered by Dr. Chun in the *Velellidæ*, a family of Siphonophores; it consists of a quite typically differentiated plexus of branching and intercommunicating ganglion-cells.——The coloring matter of jelly fishes has been investigated by Professor McKendrick, who finds that it consists of little irregular particles scattered through the protoplasm. It was also examined with the spectroscope.——The sixth and seventh parts of Bütschli's Protozoa have appeared. This work forms a volume of Bronn's *Classen und Ordnungen des Thierreichs*. The author believes that Bessel's account of Bathybius is worthy of all confidence, while he inclines to the view that Eozoon is inorganic.——The sexual organs of the harvest men (Phalangidæ) have been critically examined by Dr. Blanc, who, after describing the testes and ovary, states that in young males eggs often occur on the surface of the testes; so that here there is a rudimentary hermaphroditism, the structural arrangement, however, not permitting self-fertilization.——Whether the shells of Planorbis are dextral or sinistral, Mr. R. E. C. Stearns discusses in a very interesting and suggestive paper in the Proceedings of the Academy of Natural Sciences, of Philadelphia. He believes that they are sinistral. The variations in the shells of certain species are then described in a way to be of much value from an evolutionary standpoint.——The publication of the Bulletin of the Buffalo Society of Natural Sciences has been resumed by the issue of the first number of Volume IV, the most interesting article in which is Mr. E. E. Fish's on the imitative and ventriloquial power of birds, containing original observations of merit.——A third paper on American spiders, by Count Keyserling, appears in Verhandlungen der K. K. Zoöl.-bot. Gesellschaft in Wien. Among the new species are *Epeira cavatica* from caves in Kentucky, and *Cœlotes juvenilis* from Mammoth cave.——We glean the following notes from the Proceedings of the U. S. National Museum, June–August: Capt. Bendire has shown that the supposed land-locked little red salmon (*Oncorhynchus kennerlyi*) of the Upper Columbia, is nothing but the young breeding male or grilse of *Oncorhynchus nerka*.——The genera and species of the family *Centrarchidæ* are reviewed by Mr. C. L. McKay. The detailed review of the genus Centurus will interest ornithologists, while there are several descriptive ichthyological papers by Bean, Jordan, Lockington, Rosa Smith and Gill.

ENTOMOLOGY.[1]

NOTES ON HYDROPHILUS TRIANGULARIS.—The article by Mr. Garman in the August number has provoked an inquiry as to the appearance of the water beetle there referred to. The accompanying illustration (Fig. 1, *b*) will, we believe, convey the desired information even better than could words.

Having, in 1876, reared *Hydrophilus triangularis* from the egg to the perfect state, and made a number of notes upon it, we would take this occasion to supplement Mr. Garman's article with a few facts that may interest the general reader. The asymmetry in the jaws, noted by Mr. Garman, is constant so far as we have observed, and is, in fact, quite common in Carabidæ generally. The egg-case of *H. triangularis*, described by Mr. Garman, differs materially from that of the European *H. piceus*, according to descriptions of this last. We found the former to consist virtually of three distinct parts, and the subsidiary figure (2) will, perhaps, more fully indicate these parts than did Mr. Garman's outlines. There is, *first*, what may be called the floater (Fig. 2, *c*), which

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

itself is composed of two parts, viz: (1) a hard spatulate piece of compact brown silk, smooth externally and with the two edges of the tapering end curled inside and welded at tip so as to form a

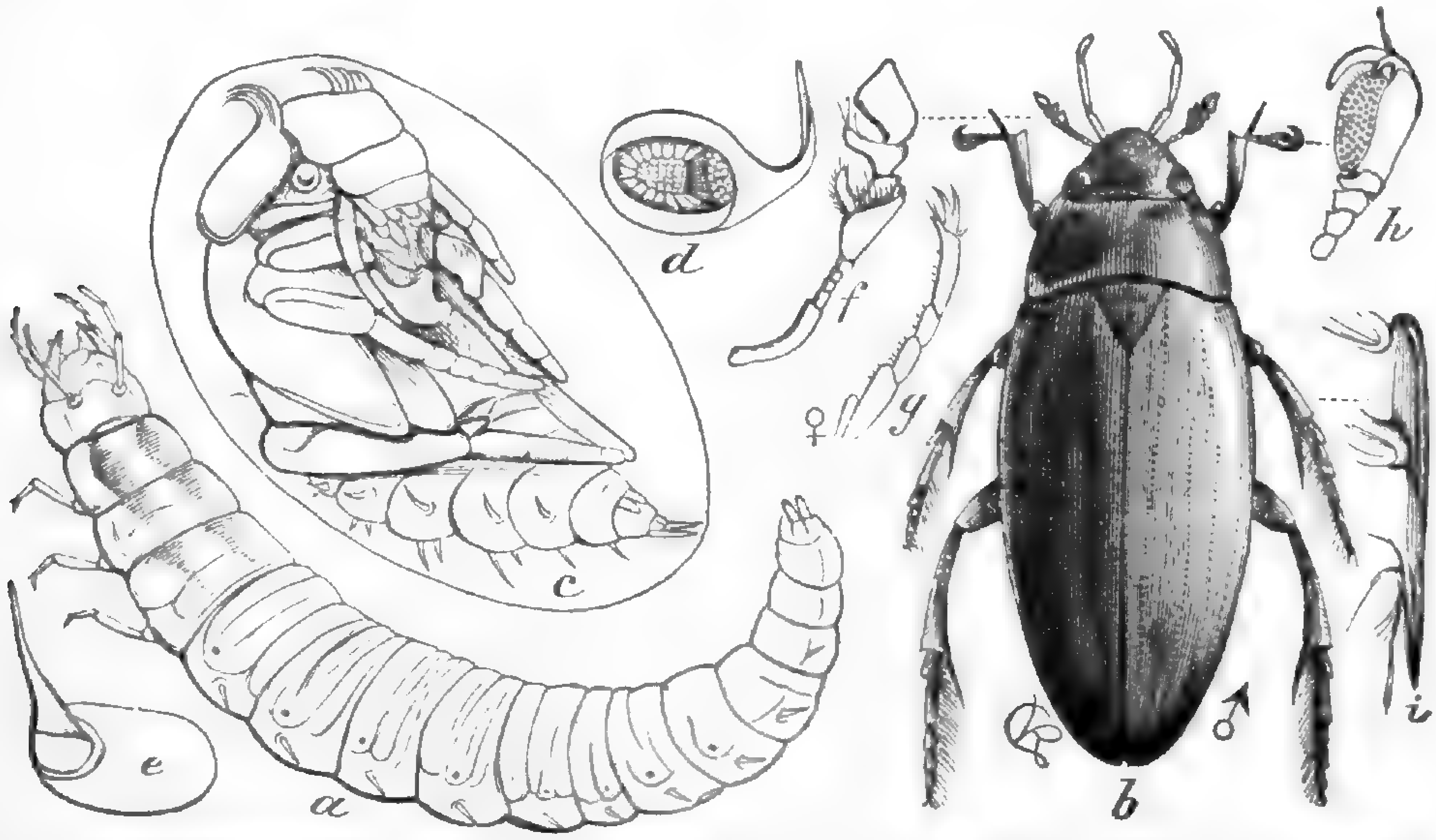

FIG. 1.—*Hydrophilus: a*, larva of *H. piceus*; *c*, pupa of same; *d*, opened egg-case showing arrangement of eggs; *e*, closed do; after Blanchard; *b*, ♂ of *H. triangularis*; *f*, antenna of same; *g*, front tarsus ♀; *h*, do of ♂; *i*, stout sternal spine, side view; after Riley.

stout point (Fig. 2, *g*), and (2) a somewhat cuneiform air-chamber (Fig. 2, *d*, *h*). There is, *second*, the egg-case proper (Fig. 2, *i*), and, *third*, the outer bag or covering (Fig. 2, *f*, *k*). The air-chamber has an external, slightly bulging covering (*d*) of the same character as the outer bag of which it forms a part, but of somewhat darker silk, while the inside *(h)* consists of loose brown silk forming large cells and connecting with the spine, the hollow parts of which are in fact filled more or less compactly with these

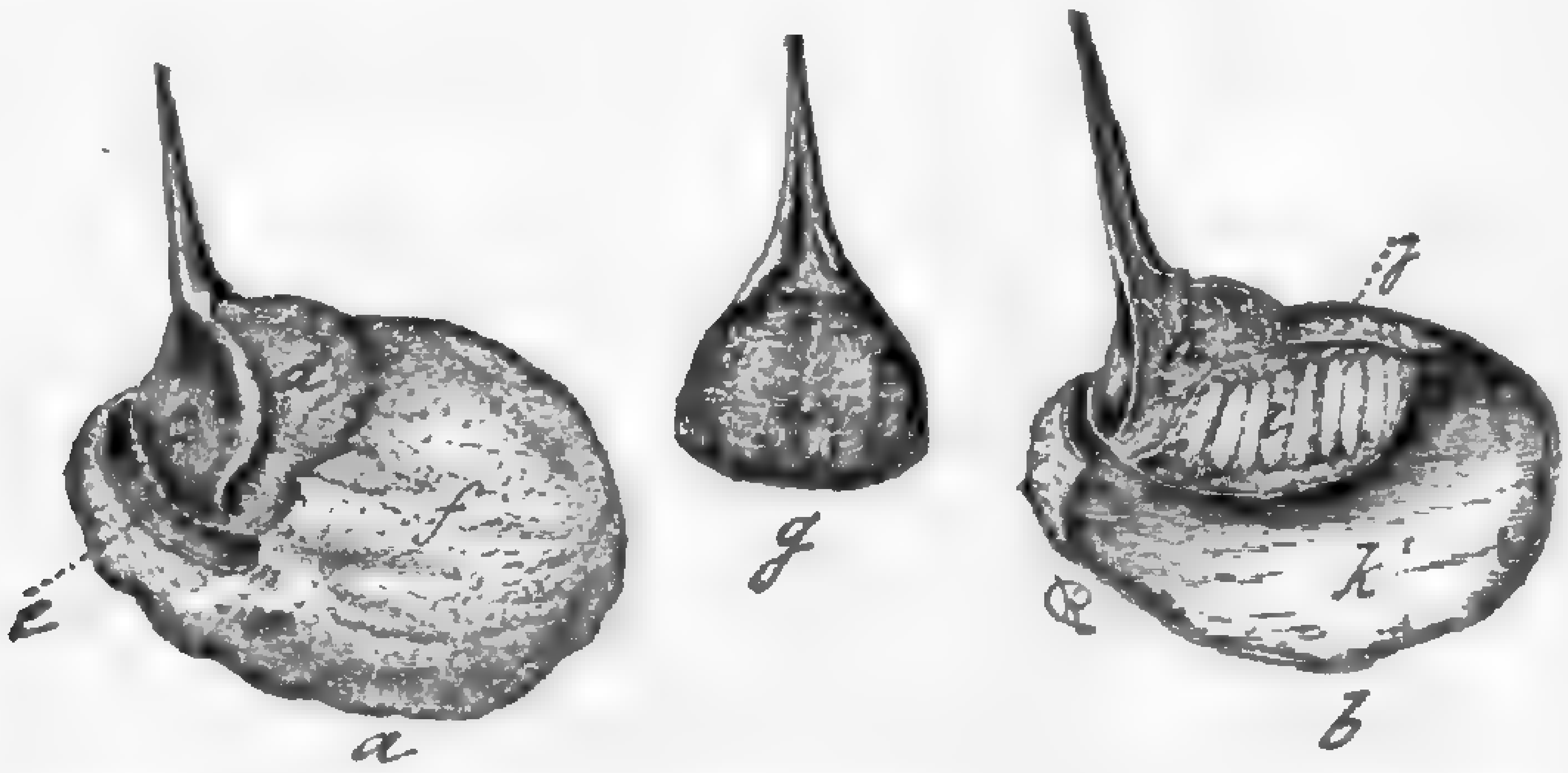

FIG. 2.—Egg-case of *Hydrophilus triangularis: a*, full side view; *c*, floater; *d*, air-chamber; *f*, outer bag; *e*, opening; *g*, floater detached, showing inner side; *b*, ideal sectional view of *a*, showing the three divisions of air chamber (*h*), egg-case proper (*i*) and outer bag (*k*)—after Riley.

silken fibers. The egg-case proper, which is of a white, rather flimsy or paper-like silk is partially suspended posteriorly from the roof of the outer bag by white loose silk, but is principally attached to the inferior side of the air-chamber, which so narrows toward the broad end of the spatulate piece that this last is virtually attached to the anterior part of the egg-case, its attachment to the outer bag being so slight as to admit of the frontal rent (Fig. 2, *e*).

The young larvæ generally break through the back part of the egg-case proper and remain for a day or two, and until they have visibly increased in size, within the outer bag, issuing finally through the frontal rent through which the water is easily admitted. When floating freely the floater is always mostly out of water, the point upward and obliquing slightly forward. The eggs are thus bathed in water but freely aërated. The spike seems to be essential to their well-being, as Mr. A. G. Laker[1] found that those of *H. piceus* failed to hatch when it was cut off, yet the somewhat similar case of the common *Hydrobius fuscipes* has no such point, but in its place the silk is extended from beneath the leaf to which the case is attached to the upper surface over which it is spread, and according to Mr. Laker they will hatch if kept entirely under water.

We conclude that the curious contrivance in *Hydrophilus* is intended not only to secure an ample supply of air to the eggs and to protect them, but also to protect the newly hatched young from their numerous enemies until their jaws have strengthened and they are better able to begin the struggle for existence.

We have often been curious to know whether or not the sternal spine of the beetle was used to form the point of the floater. It seems useful for such a purpose and yet occurs in both sexes. If any of the readers of the NATURALIST have ever observed the formation of this curious egg-case, we shall be glad to have the process described.

The larva loses its hairiness after the first molt, and the mature larva differs from the young larva principally in the relatively shorter legs and mouth-parts. We were struck with the ravenousness and rapid growth of this larva, those hatching on the 26th of July having passed through the first molt on the 30th of the same month, and through a second molt on the 3d of August. The larva of *H. piceus* is said by European writers to pass through three molts, but we observed only two in our larvæ. They were full grown a week later, and by the 5th of September the first one had gone through its transformations, and issued as a beetle. The molt takes place in all sorts of situations, and even while the larva is floating on the surface of the water. The color becomes paler toward each molt but dark afterwards, the characteristic dark and sordid-white mottlings, especially the wavy lines along the back, being most conspicuous just after the molt. They fed on everything with which they came in contact, as young Ephemerid and Libellulid larvæ, other aquatic animals, and even raw beef which we gave them.

The pupa, which was readily formed in a large flower pot filled

[1] *The Entomologist* (London, Eng.), XIV, p. 83.

with earth kept well moistened, closely resembles that of *H. piceus* of Europe, so that the figure of that species here given (Fig. 1, *c*) will very well illustrate its appearance. The anal appendages are much longer in our species, very stout and parallel in their basal third, thence suddenly narrowed and slightly divergent. They are annulated and their length seems to vary according to the specimens. In the middle of the anal joint there is ventrally a triangular tubercle, and on the apical margin of the penultimate joint are two more prominent, connected, cone-like protuberances. The anal joint dorsally terminates in two stout, short tubercles, each bearing a spine. The pupa is chiefly characterized by the sternal process or spine, and by having on each abdominal joint behind each spiracle, a filamentous, curved, tapering process, minutely annulate and with a seta issuing from tip. On each side of the anterior border of the prothorax is a set of three of these processes largely developed. Their function has not been critically studied, but they undoubtedly act as secondary tracheæ.—*C. V. Riley.*

THE CULTIVATION OF PYRETHRUM AND MANUFACTURE OF THE POWDER.[1]—2. *Application of Pyrethrum in Fumes.*—The powder burns freely giving off considerable smoke and an odor which is not unpleasant. It will burn more slowly when made into cones by wetting and molding. In a closed room the fumes from a small quantity will soon kill or render inactive ordinary flies and mosquitoes, and will be found a most convenient protection against these last where no bars are available. A series of experiments made under our direction, indicates that the fumes affect all insects, but most quickly those of soft and delicate structure.

This method is impracticable on a large scale in the field, but will be found very effective against insects infesting furs, feathers, herbaria, books, etc. Such can easily be got rid of by enclosing the infested objects in a tight box or case and then fumigating them. This method will also prove useful in greenhouses, and, with suitable instruments we see no reason why it should not be applied to underground pests that attack the roots of plants.

3. *Alcoholic Extract of Pyrethrum powder.*—The extract is easily obtained by taking a flask fitted with a cork and a long and vertical glass tube. Into this flask the alcohol and Pyrethrum are introduced and heated over a steam tank or other apparatus. The destillate, condensing in the vertical tube, runs back, and, at the end of an hour or two the alcohol may be drained off and the extract is ready for use. Another method of obtaining the extract is by repercolation after the manner prescribed in the American Pharmacopœia. The former method seems to more thoroughly extract the oil than the latter; at least we found that the residuum of a quantity of Pyrethrum from which the extract was obtained by repercolation had not lost a great deal of its power. The first

[1] Concluded from September number.

method is apparently more expensive than the other, but the extract is in either case more expensive than the other preparations, though very conveniently preserved and handled.

The extract may be greatly diluted with water and then applied by means of any atomizer. Professor E. A. Smith of Tuscaloosa, Ala., found that, diluted with water, at the rate of one part of the extract to 15 of water, and sprayed on the leaves, it kills cotton worms that have come in contact with the solution in a few minutes. The mixture in the proportion of one part of the extract to 20 parts of water was equally efficacious, and even at the rate of 1 to 40 it killed two-thirds of the worms upon which it was sprayed in 15 or 20 minutes, and the remainder were subsequently disabled. In still weaker solution or at the rate of 1 to 50 it loses in efficacy, but still kills some of the worms and disables others. Professor Smith experimented with the extract obtained by distillation, and another series of experiments with the same method was carried on last year by Professor R. W. Jones of Oxford, Miss.[1] He diluted his extract with twenty times its volume of water and applied it by means of an atomizer on the cotton worm and the boll worm with perfect success. Mr. E. A. Schwarz tried, last summer, the extract obtained by repercolation[2] and found that 10 drachms of the extract, stirred up in two gallons of water and applied by means of Whitman's fountain pump was sufficient to kill all cotton worms on the plants. Four drachms of the extract to the same amount of water was sufficient to kill the very young worms.

4. *Pyrethrum in simple water solution.*—So far as our experiments go, this method is by far the simplest, most economical and efficient. The bulk of the powder is most easily dissolved in water, to which it at once imparts the insecticide power. No constant stirring is necessary and the liquid is to be applied in the same manner as the diluted extract. The finer the spray in which the fluid is applied the more economical is its use and the greater the chance of reaching every insect on the plant. Experiments with Pyrethrum in this form show that 200 grains of the powder stirred up in two gallons of water is amply sufficient to kill the cotton worms, except a very few full-grown ones, but that the same mixture is not sufficiently strong for many other insects as the boll worm, the larva of the *Terias nicippe* and such species as are protected by dense, long hairs. Young cotton worms can be killed by 25 grains of the powder stirred up in two quarts of water.

The Pyrethrum water is most efficacious when first made and loses power the longer it is kept. The powder gives the water a light greenish color which, after several hours, changes to a

[1] Vide *American Entomologist*, Vol. III, pp. 252–3.
[2] From one pound of the powder one pint of extract was made, each drop of the extract representing one grain of the powder. The actual cost of making the extract was 50 cents.

light brown. On the third day a luxuriant growth of fungus generally develops in the vessel containing the liquid, and its efficacy is then considerably lessened.

5. *The Tea or Decoction.*—Professor E. W. Hilgard of Berkeley, Cal., is the only one who has experimented with Pyrethrum in this form and expresses himself most favorably as to the result. He says:

"I think, from my experiments, that the *tea or infusion, prepared from the flowers* (which need not be ground up for the purpose) is the most convenient and efficacious form of using this insecticide in the open air; provided that it is *used at times when the water will not evaporate too rapidly*, and that it is applied, not by pouring over in a stream, or even in drops, but *in the form of a spray from a syringe* with *fine* holes in its rose. In this case, the fluid will reach the insect despite of its water-shedding surfaces, hairs, etc., and stay long enough to kill. Thus applied, I have found it to be efficient even against the armored scale-bug of the orange and lemon, which falls off in the course of two or three days after the application, while the young brood is almost instantly destroyed. As the flower tea, unlike whale soap and other washes, leaves the leaves perfectly clean, and does not injure even the most tender growth, it is preferable on that score alone; and in the future it can hardly fail also to be the cheaper of the two. This is the more likely, as the tea made of the leaves and stems has similar, although considerably weaker, effects; and if the farmer or fruit grower were to grow the plants, he would save all the expense of harvesting and grinding the flower-heads, by simply using the header, curing the upper stems, leaves, and flower-heads all together, as he would hops, making the tea of this material by the hogshead, and distributing it from a cart through a syringe. It should be diligently kept in mind, that the least amount of *boiling* will seriously injure the strength of this tea, which should be *made* with briskly boiling water, but then simply covered over closely, so as to allow of as little evaporation as possible. The details of its most economical and effectual use on the large scale remains, of course, to be worked out by practice."

The method of applying Pyrethrum in either of the three last-mentioned forms is evidently far more economical in the open field and on a large scale than the application of the dry powder, and, moreover, gives us more chance of reaching every insect living upon the plant to which the fluid is applied. The relative merits of the three methods can be established only by future experience.

Migration of Plant Lice from one Plant to another.—M. J. Lichtenstein of Montpellier, France, whose important entomological writings are known here as well as in his own country, has been appointed by his Government to especially study all questions relating to the habits of the Aphididæ. M. Lichtenstein has for some years fully believed that most of our Aphids, and especially the gall-making *Pemphigini*, habitually migrate, in the winged, parthenogenic, female form, from one plant to another, and that the species must necessarily inhabit two different plants before it passes through its full cycle of development. That it is the rule for most of the insects of this family to so migrate is evident from the fact, patent to all who have observed them, that there is a period in mid-summer when most of the species abandon the plants which they so seriously affect in spring and early summer. This disappearance, emphasized already in 1829, by Joshua Major, in treating of the apple tree plant louse,[1] has usually been attributed to natural enemies of the Aphids, but these play only a part in causing it. The fact of migration rests, moreover, on repeated direct observations, and all spring gall-inhabiting species have usually vacated their galls by mid-summer. The air has often been seen to swarm with Aphids, and Reaumur observes that in migrating they sometimes actually darken the air. In fact it is now coming to be well understood, that in this family the habit of the same species in spring is quite different to its habit in the fall, and that in the study of the insects of this family there is opened up to us a new and interesting field for observation comparable to that of late years developed by the discovery of dimorphism in the *Cynipidæ*. We have for some time since recognized this fact of migration, but have been led to believe from the known facts in the case that the migration was necessarily from one plant to another of the same *genus*. M. Lichtenstein, on the contrary, believes that the change is still more wonderful and that many tree-inhabiting and gall-making species actually have a mid-summer life on the roots of grasses and herbaceous plants. He has recently communicated to us some discoveries that certainly justify his views. In the genuine *Aphidini* he has ascertained that *Aphis (Phorodon) humuli* migrates from *Prunus* to *Humulus*, and that *Aphis (Myzus) asclepiadis* Passerini *(nerii* Boyé*)* migrates from *Asclepias* to *Nerium*.

The Chinch Bug.—The connection of meteorological conditions, especially the amount of rain-fall, with the increase or decrease of this notorious pest has long been recognized by entomological writers. From a *résumé* of the chronological history of bad chinch bug years and the effect which temperature may have on the insect, Professor Cyrus Thomas showed a year ago *(American Entomologist*, Oct., 1880) that the insect would probably be bad in 1881. How disastrous it really has been in the Western States, especially in Kansas, may be gathered from the fact that a chinch bug convention, the first ever held in the U. S., was held recently at Windsor, Kansas. A large number of farmers participated in the discussion, and a resolution to exclude wheat from the growing crops was unanimously adopted—the length of time not being mentioned. It is understood, however, that the planting will be resumed at the earliest possible practicable period. Anticipating that this would be a bad chinch bug year, Professor Thomas recommended the sowing of a larger area of oats, and had this advice been more generally adopted it would have been of great benefit to the farmers of that region. The insect has been quite common in all parts of the country the present year. It attacked and injured, during the month of August, the rice fields in the vicinity of Savannah, Ga., and was noticed in July in great

[1] Treatise on Insects most prevalent on Fruit Trees and Garden Produce. London, England, 1829.

numbers on "sand-oats" and other grasses growing on the dunes at Fortress Monroe, Va.

PHYLLOXERA LAWS.—The existing laws regulating the traffic in plants with a view of preventing the introduction of the Grape Phylloxera, are thus summarized in the annual report of the Syndical Chamber of Nurserymen at Ghent.

"Introduction of living plants is wholly forbidden in Italy, Spain, Turkey, Roumania, Algeria, Cape of Good Hope.

"Introduction of living plants is permitted as usual, except in the case of vines, which are prohibited—Germany.

"Introduction of living plants packed as usual, is permitted, but with a certificate of origin, in Switzerland; and a similar certificate attested by a consul in Austria-Hungary.

"Introduction under ordinary conditions if provided with a consular certificate, *viséed*, is allowed in Portugal and its colonies."

ONE HALF THE VINE AREA OF FRANCE AFFECTED BY PHYLLOXERA.—The British Consul at Bordeaux, in a recent report, states that of the 2,200,000 hectares [one hectare = 2½ acres nearly] of vineyards in France, about 500,000, or nearly one-fourth are destroyed by the grape Phylloxera, while as many more are attacked. He states that the only sure remedy is submersion, which is resorted to with invariable success wherever possible. The only available preventive is by the use of our resisting American stocks.

LONDON PURPLE AND PARIS GREEN.—Professor C. E. Thorne, of the Ohio State University, has found by experience, during the past two years, that weight for weight London purple is more efficacious than Paris green as an insecticide. There is really no need of using it weight for weight, as one half a pound of the purple goes as far as one pound of the green and costs very much less. Though from the cheapness of the former there is less temptation to adulterate it than with the latter, yet there are still cheaper powders with which it may be and has been adulterated. If not carefully ground it is less effectual and apt to form lumps in mixing with water. Hemingway & Co., of New York, the originators of this insecticide, are taking particular pains to grind finely, experience having taught that increased care is warranted in the increased satisfaction which their article gives. Another purple poison is now being advertised as Paris purple. The base is a purple refuse obtained by A. Pourrier, of Paris, extensively used for coloring sugar paper, for the very reason that there is no arsenic or other poison in it. But as it costs but $1.75 per ton in Paris, enterprising parties are using it in imitation of London purple by adding the arsenic to it.

ENTOMOLOGIST FOR THE PACIFIC COAST.—At the recent well-attended meeting of the California Viticultural Commission, the desirability of having a state entomologist was discussed, and a report submitted of the efforts hitherto made to create a chair of entomology in the State university. The people of the Pacific coast are evidently alive to the importance of studying their insect enemies, and we may expect soon to see some definite action taken by the State government.

Dilar in North America.—Mr. R. McLachlan describes in the August number of the *Entomologist's Monthly Magazine* (p. 55), under the name of *Dilar americanus*, the first species of this very singular (Neuropterous) genus known from North America. The typical specimen (a female) was collected by Mr. F. G. Sanborn at Bee Spring, Ky., in June, 1874.

Locusts in Nevada.—The *Reno* (Nevada) *Journal* reports that the countless locusts that hatched in Western Nevada this spring did not do any damage, but emigrated in great swarms after having acquired wings, towards the Sierra Nevada, failing, it seems, to cross the mountains.

Odor in Butterflies.—Dr. Fritz Müller read a paper before the London Entomological Society, June 5, 1878, on the peculiar odor emitted by the males of some Brazilian butterflies. Miss Mary E. Murtfeldt calls attention, in the April number of *Psyche*, to the fact that some years before the publication of Dr. Müller's paper she observed, while spreading fresh male specimens of *Callidryas eubule*, a delicate, violet-like odor emitted from the specimens, and which was retained, to some extent, for several days; the females being not at all fragrant.

Entomology at the recent meeting of the A. A. A. S.—Our report of the meeting of the permanent sub-section of Entomology of the A. A. A. S. is crowded out of this number.

ANTHROPOLOGY.[1]

The Indians of Berks county, Pa.—In our bibliographical list will be found the complete title of a work upon the Indians of Berks county, Pennsylvania, by Mr. D. B. Brunner. The volume consists of 110 pages of printed matter and 34 plates, containing 176 figures of stone implements and pottery. The people who held this territory when it was visited by the whites were the Delawares, or *Lenni Lénape* (original people), divided into three sub-tribes: the *Unamis*, or Turtles, the *Unalachtgos*, or Turkeys, and the *Minsis*, or Wolves. The Wolf tribe extended over the south-eastern part of Pennsylvania, including Berks county. The greater part of the matter in the volume is of the highest local interest, but there are several sections invaluable to the anthropologist. We notice on page 65 a very sensible and sufficient reason assigned for the Indian massacres and the expulsion of the Delawares from Berks county. Some allusions to aboriginal writing will be found at page 68, to cemeteries on page 73, to collections

[1] Edited by Prof. Otis T. Mason, 1305 Q Street, N. W., Washington, D. C.

of relics, page 76, followed by quite an elaborate description of the principal types.

It needs only a little observation to remark what kinds of books and information students of our day are most eager to procure relative to the centuries that are gone. It is doing no violence to the rules of logic to infer that the men of the coming centuries will laugh at our vain speculations and pay enormous prices for old books which contain solid, local information. We never read a work of this character without wishing to take the author by the hand. The greatest scrupulosity should be exercised in compiling such records, for in most cases they become the court of last appeal.

THE ANTHROPOLOGICAL INSTITUTE OF GREAT BRITAIN.—Volume x, No. III, issued in Feb., 1881, is at hand. The contents are as follows:

Brabrook, E. W.—Memoir of the late Paul Broca, honorary member, with a portrait, pp. 242–260.

Codrington, Rev. Robert Henry—Religious beliefs and practices in Melanesia, pp. 261–314.

Lubbock, Sir John—Notes on a stone implement of Palæolithic type found in Algeria, pp. 316–319.

Price, F. G. Hilton—Camps on the Malvern hills, pp. 319–330.

Fison, Rev. Lorimer—Land Tenure in Fiji, pp. 332–351.

Gooch, William D.—Notes on the occurrence of stone implements in South Russia, pp. 352–357.

One is not astonished to find stone implements anywhere in our day, and these belonging to the various classes set up by specialists. Sir John Lubbock lays before us a specimen of palæolithic type from Algeria. In the same paper he denies objects of this class to Russia. The edge is quite taken from this assertion, however, by the paper of Mr. Gooch, in the same number, wherein appears the drawing of one very rude implement from that quarter.

Of more general interest are the papers of Messrs. Codrington and Fison.

To begin with the former, the observations of beliefs were confined principally to the Banks, New Hebrides, and Solomon groups. The beliefs of the Banks group are first worked up with care and those of the other two are then compared with these. Some very just observations are made upon the two difficulties in the path of the observer of religious phenomena among lower races, viz: the difficulty of sympathizing with the people and the want of a vocabulary.

The author also endeavors to trace the evidences of mixture in blood between the Negritos and pure Polynesians by the changes wrought in their beliefs. This is dangerous ground. The truth is, regulative ideas give place before a different civilization slowly, and so far as yet known capriciously. Again, we are constantly met with the dictum that like causes produce like effects in culture.

The Melanesians believe in ghosts, *Tamate*, and spirits, *Vui*, the former are the disembodied spirits of men, the latter including beings corporeal and incorporeal, but never human. The reader will be highly interested in the slight step which this theology has made above fetichism, as, for instance, on page 275, "These *Vuis* are very generally associated with stones. It is not that the stone is a *Vui*, or that the *Vui* is in the stone, but that there is a connection between the *Vui* and the stone, that the stone is the spirit's outward part or organ. To a certain extent the same connection exists between *Vuis* and snakes, owls and sharks."

Mr. Lorimer Fison's paper touches most interestingly upon one of our own difficulties. Time and again we have been told, after paying a round sum to extinguish some Indian title: Those men had no right to make that treaty; according to the usage of our tribe the Council were the proper parties. So in Fiji, "an investigator who will listen to that only which the chiefs have to say about it, may easily come to the settled conviction that they, and they alone, are the owners of the land, and indeed of everything else; while another who takes the statement of the commoners only, may easily satisfy himself beyond all doubt that it is they who are the real proprietors of the soil. Both of these inquiries would be right to a certain extent, and both of them would also be wrong. The statement of the commoners I believe to represent the ancient custom. That of the chiefs sets forth the extent to which they have been able to override the custom."

HARVARD UNIVERSITY BULLETIN.—One must have many eyes to keep the run of anthropology. Mr. Justin Winsor, the librarian of Harvard University, is issuing monthly bulletins of the University in continuation of the Library Bulletin. The accessions to the Peabody Museum library appear in the lists. On page 216, June number (No. 19; or Vol. II, No. 6) will be found an account of explorations at Madisonville, Ohio, by Professor F. W. Putnam.

THE ARCHÆOLOGICAL INSTITUTE OF AMERICA.—The first of the American series of papers to be issued by the Archæological Institute of America, is a neat volume in sober brown octavo, containing 133 pages and eleven plates. It is the report of Mr. A. F. Bandelier upon his researches among the Pueblos, and consists of two distinct portions: 1. Historical introduction to studies among the sedentary Indians of New Mexico; and 2. Report on the ruins of the Pueblo of Pecos. As our praise will be much longer than our censure, it were better to administer the latter first. Well, here is a handsome book with neither table of contents nor index to guide the eager seeker after truth. This, however, is a venial offence compared with the reckless manner in which the excellent plates are scattered about the volume. As we conscientiously hunted them all out, a list with their localities is appended: Plate XI, front; VI, page 41; VII, page 42; I, page

45; IX, page 47; II, page 52; III, page 58; IV, page 67; X, page 70; V, page 78; VIII, page 81.

Both chapters are among the very best of Mr. Bandelier's writings, the latter especially meriting our unqualified praise. It shows what an enthusiastic man can do who adds to a profound knowledge of what has been accomplished, a clear apprehension of what remains to be done. The present volume is also free from that overburdening of foot-notes, which renders Mr. Bandelier's former treatises difficult to read, and lays him open to the charge of pedantry.

In the Historical Introduction the author not only utilizes the very latest authorities, but has enjoyed rare opportunities of examining unpublished manuscripts through the courtesy of his friends in Mexico and New Mexico.

The description of the Pecos ruins occupies the greater part of the book. About thirty miles south-east of Santa Fé, the valley of the Rio Pecos widens into a triangular space, in the center of which rises a table land on whose southern end are located the old church of Pecos and directly north the ruins of the ancient Pueblos. The church was erected about 250 years ago by the Indians, under the direction of the Catholic fathers. It is now a total ruin, even the roof having been used for building outhouses. There were two grand edifices upon the mesilla besides numerous smaller ones. From the walls now standing, Mr. Bandelier was able to secure enough measurements to recover the ground plans of the two ancient Pueblos, one of which was an oblong building, the other a hollow square partly open on the south; the area was enclosed by a wall of circumvallation. It will be impossible to do more than to allude to the excessive care exercised in securing the measurements of the hundreds of rooms in detail.

Three periods of occupation were brought to light in the investigations; a pretraditional epoch, marked by corrugated pottery; a traditional epoch, and a documentary epoch.

The pretraditional epoch rests upon the discovery of walls and graves built above a layer of ashes, charcoals, corncobs and corrugated pottery. The traditional period, which is also partly documentary, commences at an epoch unknown, but marked by glazed pottery and pueblo structures, and extends to 1598. The documentary period covers the remaining time up to the present day, although we are indebted to modern vandalism for the loss of precious material. The explosion of the Montezuma myth, p. III, is done in Mr. Bandelier's best manner.

ANTHROPOLOGY IN NEW ZEALAND.—There is no foreign journal of scientific work more prompt in its appearance than the Transactions and Proceedings of the New Zealand Institute, the thirteenth volume of which, issued April, 1881, is now before us.

The papers will be noticed under the title of their authors for the convenience of the bibliography:

Colenso, W.—On the Vegetable Food of the ancient New Zealanders before Cook's visit, pp. 3–38.

———Historical Incidents and Traditions of the olden times translated from old Maori writings and recitals, 38–57.

———Contributions to a better knowledge of the Maori race, pp. 57–84.

Kirk, T. W.—Description of Maori comb and arrow-heads, 436.

Hocken, Dr.—Lectures on the early history of New Zealand, 452.

Zuni and the Zunians.—A very handsome quarto pamphlet of thirty pages, with the foregoing title, bearing the name of Mrs. Tilly E. Stevenson, has come into our hands. Although there is no title page, one is not long in ascertaining that Mrs. S. is the accomplished wife of Col. James Stevenson, the explorer, of Major Powell's Bureau. The lady accompanied her husband to the Pueblo country in 1879, and gives us, in the work before us, the benefit of her own observations, some of which are entirely new. The modern pueblos are very plausibly connected with the ancient cliff-houses. The collection of snow in large reservoirs to supply water in the drought of summer, links on very happily with some of Mr. Bandelier's explorations. The pueblo and people of Zuñi are very graphically described, including their house life and cookery. An important intimation is to the effect that the wealthy portion live in the lower stories, those of moderate means next above, while the poorer families have to be content with the upper stories. The grinding of meal and the baking of bread are better described than we remember to have read elsewhere.

The most important part of the pamphlet and that which is of lasting value, is the description of pottery making. We did not know before that lignite is used as a degraissant, that some ware is made of strings of clay, while other varieties are built up by means of ribbon-like strips, that a surface wash is made by rubbing down sticks of dried white clay on a fine stone, that brushes made from the Spanish bayonet are used in the decoration, that the baking is done with sheep and goats' dung; and finally, that the beautiful black gloss is imparted to some vessels by rubbing them down with the utmost care before baking, and by suffocating them with a fresh supply of dried dung just as they are done baking, in order to compel them to suck in the smoke as they cool. Really this last mentioned fact, to use a familiar phrase, is worth the price of the book. A feast of good things must be in store in the voluminous report which Col. Stevenson is preparing in reference to his collections.

The Indians of Canada.—Professor J. Campbell, of Montreal, read a paper before the Literary and Historical Society of Quebec, December 17, 1880, which has since been published in pamphlet form. The object of the lecture was no less a task than tracing the origin of the Indians of Canada. Of the eleven families within the area of the Dominion—Algonkin, Wyandot-Iroquois, Dakota, Tinné, Thlinkit, Innuit, Haida, Chimsyan, Hailtzukh, Nutka and Selish—the four families of British Columbia and the Algonkin are held to be of insular origin, or Malayo-Polynesian. The Iroquois, Dakota and Tinné are, on the contrary, derived from Tungusic and Koriak-Japanese stocks respectively.

Professor Campbell, relying upon linguistic evidence mainly, and believing that no classification of peoples can proceed on the basis of such an accident as polysynthetism, erects a new criterium in the using or not using of prepositions, as follows:

Postpositional languages place the mark of relation after the noun, the temporal index after the verbal root, the active verb after its regimen, the nominative after its genitive, the noun after its adjective.

Prepositional languages place the mark of relation before the noun, the temporal index before the verbal root, the active verb before its regimen, the nominative before its genitive, the noun before its adjective.

Nine comparative vocabularies between Indian, Polynesian and Asiatic languages close the volume.

To be candid, it has never occurred to us that there is much in the method of inquiry pursued in this pamphlet; but it is due to the author to say, that what good it possesses cannot fail to be extracted by the immense amount of time and patience which Professor Campbell is expending upon it.

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GEOLOGY AND PALÆONTOLOGY.

MAMMALIA OF THE LOWEST EOCENE.—Attention has already been directed, in these pages,[1] to the fauna of an early Tertiary period, probably the Puerco formation, which lies below the Wasatch, in New Mexico. I have recorded the presence of the Creodont genera *Periptychus*, *Triïsodon* and *Deltatherium*, and probably the Saurian *Champsosaurus*. I now add the genera *Hyracotherium*, *Meniscotherium* and *Mesonyx*, and a number of new forms of considerable interest. These are a new genus allied to *Esthonyx*, and a series of genera and species with a suilline type of dentition, but whose affinities are by no means certain. This point cannot be determined until the characters of the feet are known.

Conoryctes comma, gen. et sp. nov. *Char. gen.*—Allied to *Esthonyx.* Inferior canines not rodent-like, with conic crowns. Molars 3–3, the first one-rooted, the second two-rooted, the third with an anterior conic cusp and a posterior grinding heel. True molars consisting of two lobes, of subcylindric section, separated by deep vertical grooves. Enamel developed on internal and external faces of crowns. *Char. specif.*—Founded on a mandibular ramus which lacks the last molar, and has the crowns of the others worn. The external faces of the molars are much more exposed than the internal, and are somewhat contracted inwards. In the unworn crown there is a distinct anterior inner cusp, which is soon confounded on attrition. The heel of the last premolar has a crescentic section, the internal horn the narrower. The anterior lobe is a robust cone. The base of the second (third) premolar is oblique to the axis of the ramus outwards and forwards. It is possible that there is a minute first premolar filling the short space between the second and the canine. No cingula; enamel obscurely plicate; ramus robust. Length of molars minus the last, .0465; length of base of first true molar, .010; width of do., .009; elevation of crown do., .0055; length of base of fourth premolar, .011; width of do., .008; elevation of crown of do., .0065. Anteroposterior diameter of base of crown of canine, .010. Depth of ramus at first true molar, .023; width of do. at do., .013. This genus differs from *Esthonyx* in the form of the fourth premolar. In the latter the anterior lobe is compressed and trenchant. The species is longer than any of that genus, and nearly equal to the *Ectoganus gliriformis*.

Catathlæus rhabdodon, gen. et sp. nov. *Char gen.*—With this genus I commence descriptions of some genera with bunodont dentition, which has some resemblance to that of some of the hogs. The one above named, with *Mioclænus*, remind one of

[1] April and August, 1881.

Tetraconodon Falc. and Lydd., in the enlarged proportions of their premolar teeth. I compare the genera as follows:

I. Third and fourth superior premolars one or two-lobed externally, and with internal lobes.

a. Superior premolars with two external lobes; inferior fourth with two median cusps.

Premolars not enlarged.. *Phenacodus*.

aa. Superior premolars with one external cusp, enlarged.

Inferior fourth premolar with internal crest and cusp................ *Catathlæus*.

Inferior fourth premolar without internal crest or cusp................ *Mioclænus*.

II. Superior premolars 1, 2 and 3 without inner lobe; third with three external lobes (Pictet).

Premolars compressed.. *Dichobune*.

In the genus *Catathlæus* the development of the premolars is remarkable, while the true molars are relatively small. The last three superior premolars have an elevated internal crescentic cingulum, homologous with the inner lobe of the fourth superior premolar of the ruminants. The general character of the true molars is that of *Phenacodus*. Parts of two or three individuals of this species have come into my possession, one of which includes nearly all of the molar dentition of both jaws. The external cusp of the superior premolars is compressed conic, and the internal cingulum extends to its *anterior* base in the second, third, and fourth. The crown of the last true molar is about as long as wide, while that of the first is wider than long. Each supports seven cusps; two subconic external; one large median internal, which is connected by ridges with a small anterior and posterior median. Then there are a small anterior and posterior internal, making three internal. The internal crest is distinct from the principal cusp in the inferior premolars III and IV, but unites with it in the II; it supports on the IV, an anterior, a median and a posterior cusp, the latter forming part of the rather narrow heel. The true molars I and II have seven tubercles, the four principal ones, and three smaller, one anterior, one posterior, and one median. On the third the posterior forms a large heel. All of the molars, but especially the premolars, have the enamel thrown into sharp parallel folds, in a manner I have not seen in any other mammal. Length of six superior molars, .067; length of three true molars, .029; length of base of third premolar, .012; width of do., .012; width of base of first true molar, .010; do. of third true molor, .009; length of do., .010. Length of base of fourth inferior premolar, .012; width do., .012; of third true molar, .0115; width of do., .009. The teeth indicate an animal of the size of the peccary.

Mioclænus turgidus, gen. et sp. nov. This genus differs from *Catathlæus* in the greater simplicity of the structure of the inferior premolars, which are without internal crest or cusp. The inner lobe of the superior premolars is less developed than that genus. In the *M. turgidus* the characters of *Mioclænus* are best seen in the subconical tubercles of the premolars, particularly that of the heel of the fourth inferior premolar. In the other three species this heel is more of a crest, and is connected with the principal cusp by a low ridge. The four species may be characterized as follows:

a. Cusps of last premolars conical in both jaws.
Size medium. Last lower molar disproportionately small; cusps low, two anterior inner distinct; true molars, .018........................ *M. turgidus.*

aa. Cusps of last premolars compressed in both jaws.
Least. Second and third lower true molars subequal; cusps, especially the internal, elevated; anterior inner confluent into an edge; true molars, .013 *M. angustus.*
Medium. Last inferior molar larger than penultimate; true molars, .014; p. m. III .006.. *M. sectorius.*
Largest. Cusps of inferior molars obtuse; p. m. III .008, its heel short and small *M. mandibularis.*

Of *M. turgidus* there are two specimens; of *M. sectorius* three, and of *M. angustus* and *M. mandibularis* one each.

Geology of the Lake Valley Mining District.—This district lies in the Eastern foothills of the Mimbres mountains, New Mexico, at the western border of a plain which extends from the Rio Grande. Several cuttings of the Atchison, Topeka and Santa Fé R. R. disclose the formation of the surface of the plain, while the shafts at the mines, and various monoclinal hills exhibit the general structure of the country.

The more elevated hills are dikes of trachyte-porphyry, and the directions of their axes are various. It partly decomposes into a reddish soil, and partly breaks down into gravel-like fragments. The lowest sedimentary rock I have seen in place is a quartzite, frequently not very hard, and often perforated by irregular cavities. This material forms low hills, and is overlaid by one or two hundred feet of a fine carbonaceous shale from which most of the valleys are eroded. I was unable to determine the age of either this bed or the quartzite. Overlying the shale are from 150 to 200 feet of more or less siliceous limestone, the upper part of which is very fossiliferous. Professor White finds the fossils to demonstrate the age of this formation to be the Middle Carboniferous; see July, 1881, Naturalist.

The only formation found covering the limestone is drift. In the foothills this is composed of worn fragments of limestone and trachyte; on the plain it mostly consists of fragments of basalt, with some trachyte, which are more or less coated with lime.

The rich silver deposit which is now attracting attention to this district, is found in the limestone, which forms low monoclinal hills between the higher trachyte ridges and the still lower hills of quarzite. At the Lake Valley mines the dip of the strata is S.S.W. from 12° to 30°. The silver-bearing rock form numerous veins which traverse the limestone from N.W. by W. to S.E. by S., or at right angles to the dips. The veins are of various widths, from a few inches to a hundred and more feet, and they are nearly uninterrupted for a length of 4000 feet along the sloping surface of the hill. They are probably outflows from an ore body which is bedded with the limestone. At a depth of thirty or forty feet, in some of the shafts, the veins change direction so as to be conformable to the limestone, and many of the veins have been already shown to be connected below the surface. The gangue of the veins is iron oxide and carbonate, with much manganese in pyrolusite, psilomelane, etc., which are mixed with crystalline limestone, chert, etc. Galena and lead carbonate are abundant, and the silver appears as ceratargyrite, embolite and sulphuret. These are either visible in amorphous or crystalline bodies, or are disseminated in an invisible form, but in large quantity, through the gangue substances. The average of the assays is high, especially in some of the ores where the silver is not recognizable by the eye. The green embolite is easily seen in specimens from all parts of this outcrop, and in some larger bodies of gangue it colors the entire rock.—*E. D. Cope.*

A Fossil Tertiary Crayfish.—In a late number of this journal, we described, under the name of *Cambarus primævus*, a fossil crayfish from the Lower Tertiary shales of Western Wyoming. The accompanying illustrations are kindly loaned by Professor F. V. Hayden; they appear in an account of this fossil published in the Bulletin of the U. S. Geological Survey of the Territories. The *Cambarus primævus* is exceedingly interesting from the fact that it represents a period in which heretofore no fossil crayfish has been found. The soft, fine, fissile, clayey shales of the Bear river tertiaries contain not only a good many herring-like fish, but also genuine skates. The presence of land plants mingled with marine animals, shows that the waters were fresh, but communicated with the sea; the conditions were apparently those of a deep estuary into which fresh water streams ran, and in these rivers lived the crayfish. The deposits were probably lower Eocene, and may have been laid down nearer the ocean than those of Green river, if these divisions are to be retained for the Tertiary deposits of the West. At any rate, it is safe to say that the *Cambarus primævus* existed in the Bear river basin in early Tertiary times (the Green river epoch), while the Idaho Astaci were of much later age, possibly of the so-called Pliocene or transition period which connected the Tertiary with the Quaternary period. The *Cambarus primævus* may therefore be regarded as a probable Eocene crayfish.

It thus appears that there is a tolerably complete set of forms of the modern type of crayfish, beginning with the Cretaceous period and extending through the Lower and Upper Tertiary, and culminating in the present assemblage of Astaci and Cambari, with allied forms peopling the cooler parts of the northern hemisphere.

Cambarus primævus, a fossil Tertiary Crayfish.

It was the intention of the writer to examine into the geological succession of the crayfishes, but since the specimens were received for examination, the excellent and thorough work of Professor Huxley, entitled "The Crayfish," has appeared, and his inquiries into the geological succession and probable genealogy of the existing crayfish, completely cover the ground. We will condense the statements of Professor Huxley, in order that the reader may see the interest to be attached to the discovery of the Wyoming fossils.

While the shrimps or Macrura date back to the Carboniferous, being there represented by Anthrapalæmon, with, however, no special affinities to the Astaci, it is not until we ascend to the Middle Lias and strata belonging near the top of the Jurassic series that we find in the genus Eryma, of which some forty species have been recognized, a type which is closely allied to Astacus and Cambarus. It was, however, a marine form, and no fresh-water types existed in the fresh-water beds of the Wealden. In the marine deposits of the Cretaceous epoch, however, astacomorphous forms, which are known by the generic names of Hoploparia and Enoploclytia, are abundant.

"In the chalk of Westphalia (also a marine deposit) a single specimen of another Astacomorph has been discovered, which possesses an especial interest, as it is a true Astacus (*A. politus* von der Marck and Schluter), provided with the characteristic transversely divided telson which is found in the majority of the Potamobiidæ. * * *

"If an astacomorphous crustacean, having characters intermediate between those of Eryma and those of Pseudastacus, existed in the Jurassic epoch or earlier; if it gradually diverged into Pseudastacine and Erymoid forms; if these again took on Astacine and Homarine characters, and finally ended in the existing Potamobiidæ and Homarina, the fossil forms left in the track of this process of evolution would be very much what they actually are. Up to the end of the Mesozoic epoch, the only known Potamobiidæ are marine animals. And we have already seen that the facts of distribution suggest the hypothesis that they must have been so, at least up to this time.

"Thus, with respect to the ætiology of the crayfishes, all the known facts are in harmony with the requirements of the hypothesis that they have been gradually evolved in the course of the Mesozoic and subsequent epochs of the world's history from a primitive astacomorphous form."—(The Crayfish, p. 341–346.)

It will thus be seen that the discovery of an apparently fresh-water Cambarus in the Green River beds of Western Wyoming, which are supposed to be Lower Eocene strata, fills up a break in the geological series hitherto existing between the Cretaceous and Pliocene crayfishes, and shows that the dynasty of fresh-water crayfish, now so powerfully developed in the United States, began its reign during the early Tertiary period.—*A. S. Packard, Jr.*

Geological Notes.—Professor E. W. Hilgard summarizes in the *American Journal of Science* for July the facts for a hypothesis of a temporary and partial isolation of the Gulf of Mexico from the Atlantic ocean during the later portion of the Tertiary period. In the same journal Professor R. P. Whitfield refers a group of supposed fossil vegetables, named Dictyophyton, to the sponges, and in this view he is confirmed by Dr. J. W. Dawson.——Professor G. H. Stone publishes in the Proceedings of the Boston Society of Natural History, an elaborate discussion of the kames of Maine and the northern States, and in the same publication Dr. M. E. Wadsworth treats of the origin of the iron ores of the Marquette district, Lake Superior, endeavoring to prove that they are eruptive rather than sedimentary. Two other contributions to lithology are comprised in Dr. G. W. Hawe's paper on normal mesozoic diabase upon the Atlantic border, and on the determination of feldspar in thin sections of rocks, in the Proceedings of the National Museum.

GEOGRAPHY AND TRAVELS.[1]

The Imperial Gazetteer of India[2].—The six volumes of this great work now published, with the three yet to be issued, will form one of the most important additions yet made to geographical literature. That excellent authority, Mr. Clements R. Markham, contributes a review of the work to the London *Academy*, from which we learn that in 1862 Madras, Bengal and the central provinces of India, feeling the need of correct information, organized plans for supplying a want for which no provision had been made by the general government and the compilation of manuals for special districts was begun. But the need was felt of a uniform system and a central supervision. In 1869, Dr. Hunter submitted his plan. "It clearly defined the objects of the undertaking and discussed the system through which these objects might best be secured. A series of questions was prepared, the answers to which would illustrate the topographical, ethnical, agricultural, industrial, administrative, and medical aspects of an Indian district. Provincial compilers were then appointed and the series of questions served as a basis for each compiler's local survey. The accounts of the districts were brought together by an editor in each province, on a uniform plan, who prepared the gazetteer of the province, the whole being under the supervision of Dr. Hunter, as Director-General of Statistics to the Government of India. Thus, in the space of twelve years an elaborate account of the 240 districts into which British India is divided was completed, and formed the statistical survey. Such a work, intended as it is to furnish full information to administrators, must

[1] Edited by Ellis H. Yarnall, Philadelphia.

[2] The Imperial Gazetteer of India. By W. W. Hunter, C. I. E., LL.D., Director-General of Statistics to the Government of India. London, 1881.

be at once comprehensive and minute. Hence the provincial gazetteers or accounts occupy about a hundred printed volumes, aggregating 36,000 pages. A gigantic task has been completed at last, such as had hitherto baffled the efforts of all former governments. At length that central supervision and that methodical arrangement were brought to bear for the want of which so much able and conscientious work had on former occasions become labors in vain. But Dr. Hunter's services did not end here. Although the hundred volumes of information on all that relates to British India were by no means too elaborate for administrative requirements, they were not calculated for general use, and it was necessary to condense their information into an *Imperial Gazetteer* for the use of the public."

"In the Imperial Gazetteer of India great pains have been taken to secure uniformity and due proportion as well as completeness. It was necessary that every place which deserved mention should be recorded; while it was almost equally desirable that each place should receive neither less nor more space than its relative importance demanded. On this principle, about eight thousand places were selected from the statistical survey for treatment in the Imperial Gazetteer. Dr. Hunter then drew up model articles showing the exact order of subject and method of treatment; and thus, although there were several contributors, complete uniformity was secured alike in the preparation of the Gazetteer and in the method of preparing the survey."

"The principal feature of the six volumes that have now been published, is the article on India, which occupies 515 pages and is a complete work in itself. The arrangement of this admirable treatise is made in accordance with sound principles. The three bases of all statistics are space, number and time. Space is the abstract of all relations of co-existence, number of all relations of comparison, time of all relations of sequence. Under the first head Dr. Hunter gives a masterly and most interesting sketch of the geography and physical aspects of British India; under the second he furnishes details of the population; and under the third he has drawn up a condensed history of the people of India, divided into clearly marked periods, from that of the early non-Aryan races to the days of British rule. The value of this excellent historical summary is very much enhanced by the insertion in foot-notes of lists of the principal authorities for each period and each reign."

It supplies a brief but complete history of India from the original sources, Sanskrit, Mohammedan and Hindu, showing the growth of the Hindu race and religion and giving also a clear account of the present system of government.

"The three bases of statistics are naturally followed by economic statistics of production and distribution; and in the important section on agriculture and products Dr. Hunter discusses the questions of improved husbandry, of irrigation and of famines. Then follow sections on commerce and trade, arts and manufactures, mines and minerals, and on vital statistics, the whole being illustrated by a series of tables." A similar treatment is observed in the articles on Bengal and other provinces, or districts and towns.

In concluding his review Mr. Markham remarks: "The Imperial Gazetteer is the crowning work which brings the results of the great statistical survey within reach of the general public. It represents twelve years of incessant labor demanding many high qualities for its efficient execution and natural gifts such as are rarely combined in one man. Learning, experience and scholarly research were no less essential than habits of accurate thought, administrative talent, and orderly, methodical arrangement. Above all, imagination was needed—that quality without which work cannot be endued with life and movement, but remains dead, a mere receptacle of lifeless facts. It is to the rare combination of literary skill and the imaginative faculty, with the qualifications of an able and energetic administrator, that we owe the completion of this great and difficult task."

This great achievement is a model for our own people. Such a Gazetteer of the United States should be the final result of the explorations, observations and collections that have been and are yet being made under the authority of the National and State Governments.

The Arctic Campaign of 1881.—The U. S. steamer *Jeannette* sailed from San Francisco on an exploring voyage through Behrings Straits on July 8, 1879. She was supplied for three years' voyage in the Arctic regions and Captain De Long's instructions do not require him to return until the expiration of that period. The *Jeannette* was last heard from by a letter from Captain De Long, dated August 27, 1879, off Cape Serdze on the north-east coast of Siberia. She was last seen on September 2d of that year by the American whaler *Sea Breeze* about fifty miles south of Herald Island, and on the following day several whalers in lat. 70° 51′ N., long. 174° 30′ W., saw the smoke of a steamer going north a little east of due south of the island. As no news has since been received of her safety, several vessels have been ordered by the Government to visit the Arctic seas for her relief if necessary.

The U. S. revenue steamer *Corwin* sailed on May 4, 1881, from San Francisco, and has already made investigations along the Siberian coast, resulting in the discovery of relics of one of the two missing whalers in the possession of the natives, who had obtained them in November, 1880, from a wreck northward of Cape Serdze. Captain Hooper expected to sail on July 8th from St. Michaels and proceed along the American shore as far as the ice would permit and then attempt to reach Wrangell Land.

The U. S. steamer *Rodgers* sailed from San Francisco on June 16th to search for and relieve the *Jeannette*. She is a full-rigged bark of 420 tons, heavily sheathed with three-inch oak plank. She is supplied with stores for four years, including large quantities of pemmican and lime juice. She is commanded by Lieutenant R. M. Berry and has a company of 35 officers and men. The paymaster is W. H. Gilder, formerly of the Schwatka expedition. She is to proceed to the coast of Siberia and thence to Herald Island and Wrangell Land, where Lieut. Berry hopes to winter.

The U. S. frigate *Alliance* has been ordered to cruise in the northern Atlantic, visiting the coast of Spitzbergen, in view of the possible return of the *Jeannette* by the east coast of Greenland or the shores of Franz-Josef Land. The *Alliance* sailed from Norfolk on June 16th, arrived at Reikiavik, Iceland, on July 9th, and at Hammerfest on the 25th.

Congress having appropriated the sum of $25,000 to the establishment of two stations within the Arctic circle, at Lady Franklin Bay and Point Barrow, in accordance with the plan adopted by the Hamburg International Polar Conference, the parties to occupy them have been organized and despatched. The Lady Franklin Bay Colony will number twenty-six, commanded by Lieut. A. W. Greely, for twelve years acting signal officer, with two other officers, sixteen soldiers, four observers, one naturalist, two surgeons and one photographer. They sailed in the steamer *Proteus* from St. Johns, N. F., on July 7th. They go first to Disco to procure Eskimo guides, dogs and furs, and expect to be joined there by Dr. Pavey and Mr. H. Clay, who were left there by the *Gulnare* last year. The *Proteus* will then visit Lancaster Sound to see if any traces of the *Jeannette* are to be found, as is thought not unlikely, and then continue her course for Lady Franklin Bay in lat. 81° 40′. She will endeavor to call at Carey island and at the cachès made by the English in Grinnell Land, which will be supplemented by supplies from the *Proteus*. On reaching Lady Franklin Bay the vessel is to be unloaded at once, so as to return to St. Johns. The expedition is provided with a number of portable houses and full supplies of stores of the best quality, including a very large stock of anti-scorbutics. After erecting the dwelling house and observatories, a sledge party is to visit Cape Joseph Henry to seek for tidings of the *Jeannette*. Full instructions are given by the War Department for the forming of collections and taking of observations of all kinds, as recommended by the Hamburg Conference. It is expected that the station will be visited yearly by steamers to replenish stores and bring back any disabled members of the party. Lieut. Greely is ordered to abandon his station not later than September 1, 1883, if not previously visited, and retreat southward by boat, following the east coast of Grinnell Land until the relieving vessel is met or Littleton island reached.

The Point Barrow party sailed on July 18th, from San Francisco on the schooner *Golden Fleece*. It consists of ten men, including the commander, Lieutenant P. H. Ray, a surgeon, astronomer, three observers, interpreter, etc. They take 16,000 feet of lumber, for the erection of a building thirty by forty feet and astronomical and magnetic observatories. The party is excellently equipped with instruments and is provisioned for two years. A vessel is expected to reach them annually. They are to remain for three years.

Many of the outlets from the Arctic sea are this year reported unusually obstructed by ice. Heavy ice floes are reported along the Labrador coast, and the pack ice is unusually heavy and far south in the European Arctic sea—Spitzbergen being at last advices entirely inaccessible. The past winter was unusually severe in Iceland. Owing to the large flow of ice it is thought that later in the season the seas in the higher latitude will be left unusually free and navigable.

The weather on the south-west coast of Greenland during the winter of 1880–1, is stated, however, to have been the mildest ever experienced in that vicinity. No ice formed in the bays or fiords and but little snow fell. The prevalence of south-west gales is assigned as one cause of this unusual climate.

Mr. Leigh Smith sailed from Peterhead in the third week of June. On reaching Eira Harbor in Franz-Josef Land, he purposes to construct a house from materials taken with him and then explore as far north as possible. He has a company of twenty-five sailors and assistants and provisions for fifteen months.

Besides Lady Franklin Bay and Point Barrow, the stations recommended to be established by the Hamburg Conference are Upernavik by Denmark, in Northern Finnmarken by Norway, on Jan Mayen and western coast of Greenland by Austria, on Spitzbergen by Sweden, on Novaya Zemlya [already opened] and at the mouth of the Lena by Russia.

The *Nature* states that the Swedish Government has decided to send a scientific expedition to Mossel Bay in the course of next year, for the purpose of collecting meteorological information. The expedition will be directed by Capt. Malmberg and will have to remain during the summer of 1882 and the winter of 1883, in order to obtain the observations of an entire year. Mossel Bay is situated to the north of Spitzbergen, lat. 79° 54′, long. 16° 15′. The locality is well known to the Swedes. Professor Nordenskiöld stayed there in the winter of 1872–3 with three ships.

MICROSCOPY.[1]

METEORIC DUST.—From time to time fine dust, having nearly the same composition as certain meteorites, has fallen upon various parts of the earth's surface. * * * Professor Silvestri,

[1] This department is edited by Dr. R. H. WARD, Troy, N. Y.

of Catonia, recently collected some dust which fell in Sicily, and found it to contain not only metallic iron, but also nickel and various silicates and phosphates, such as are commonly found in meteoric stones. He is, therefore, inclined to believe either that the dust has been abraded from meteorites, or that it circulates in space, and is attracted to the earth's surface when it penetrates within the atmosphere.

Professor Tacchini, who has exchanged the observatory of Palermo for that of the Collegio Romano, in Rome, has recently published a lengthy memoir entitled "Sulle polveri meteoriche di Scirocco raccolte in Italia e segnatamente in Sicilia." He was assisted in his researches by Professors Macagno and Ricco, and a résumé of the results at which they arrived, was recently read before the meteorological section of the French Association for the Advancement of Science at Algiers. The memoir contains some beautifully-executed microscopic drawings of the appearance of the meteoric dust when highly magnified, and by a series of small maps showing the barometric curves for the periods during which the dust fell. * * * A notable feature revealed by the analysis, was the similarity of the composition of the dust collected from various localities and at different epochs. * * * A microscopic analysis revealed the presence of transparent and opaque polygonal crystals, black granules of metallic iron, and of magnetic oxide of iron, feldspar, carbonate of calcium and sand; various vegetable substances and spores were observed, *Palmella cruenta*, *Protococcus nivalis* v. *pluvialis* and *Discerœa purpurea.* Professor Tacchini considers that the dust is of terrestrial origin, and that it is brought from the Sahara, being raised into the higher regions of the atmosphere by cyclones and whirlwinds, where it may remain suspended during transport for several days. A barometric depression invariably accompanies the fall of the dust.—*G. F. Rodwell in Science Gossip.*

Microscopy in the American Association for the Advancement of Science.—At the meeting of the American Association for the Advancement of Science, held recently in Cincinnati, the sub-section of microscopy had several important and interesting sessions, at which a number of valuable papers pertaining to the science of histology and the *technique* of microscopy were presented. Rev. A. B. Hervey, of Taunton, Mass., was chairman, and Professor Wm. H. Seaman, of Washington, was secretary.

In the reorganization of the American Association, which was perfected at the Cincinnati meeting, the full section of "Histology and Microscopy" was established, by which this was put on a footing of equality with the other departments of science represented in the Association. By this arrangement the chairman of the section becomes a vice-president of the Association, and he, together with the secretary and a fellow elected by the section, represent the section in the standing committee. It is believed that this action on the part of the Association will be gratifying to every student of histological and microscopical science in the country. It can hardly fail to furnish the most favorable and considerable advantage to all who care to enjoy the privileges of a national microscopical society. Professor A. H. Tuttle, of Columbus, was elected chairman, and Robert Brown, Jr., of Cincinnati, secretary of the section for the Montreal meeting.—*A. B. H.*

NEW FREEZING MICROTOME.—At the microscopical section A. A. A. S., Mr. Thomas Taylor, Microscopist of the Department of Agriculture at Washington, presented a model of a new freezing microtome of his invention. Mr. Taylor described his invention as consisting essentially of a thin brass tube about one inch and a half in length by one inch in diameter. A ¼ inch brass tube is secured within the large cylinder. This tube enters the bottom where it is secured, and proceeds to within a quarter of an inch of the inside surface of the top. To the outside open end of this tube a rubber tube is attached; the other end of the rubber tube is made to communicate with a freezing mixture composed of finely cut ice and salt in about equal proportions. The pail containing this mixture is placed over and about fifteen inches higher than the section cutter. The object of this arrangement is to fill the brass cylinder with a freezing liquid, drained from the pail, and caused by the liquifying salt and ice, the temperature of which is about zero. On filling the cylinder with the liquid any object on the top of the cylinder becomes frozen in a short period and may then be cut to any degree of thickness. In order to preserve the low degree of temperature in the cylinder a second tube is secured in the cylinder to remove air and keep up a constant current of the freezing liquid. This tube enters the bottom of the cylinder, where it is fastened. It projects upwards to within an eighth of an inch of the top and has a diameter of about one-half of the supply tube. This microtome or freezing cylinder in other respects is arranged like other microtomes such as are used for ether or rhigoline; and the same mathematical accuracy attained in cutting sections.

MOUNTING CHICK EMBRYOS WHOLE.—Dr. C. S. Minot recommended the following method, for embryos under 40 hours. The egg is opened in the usual manner in warm 0.5 per cent. salt solution, the blastoderm freed from the yolk membrane, then swayed with pincers to and fro in the liquid to remove the superfluous yolk, and then floated out on a glass slide, on which it is to remain permanently. It is next treated with several fluids; *all* of which should be dropped on the center of the germ disc so as to spread out the blastoderm evenly by their centrifugal flow. Wash off thoroughly with distilled water. Remove the water as fully as possible by bibulous paper, and allow the specimen to remain fully spread out until the edges are dried. The embryo will then escape distortion during the further treatment. Care must be taken that the embryonic area remains moist. Drop on two drops of a ½ per cent. osmic acid solution, leave standing for two or three minutes until a slight browning is produced, wash off again with distilled water, strain with picrocarmine, which dyes the blastoderm after a variable time according to the intensity of the osmic acid action. The next step is important because it stops the further darkening by the osmium, which otherwise injures or ruins the specimen. Pour Müller's fluid, or 0.5 per cent. chromic acid solution on the slide and leave it over night. The next morning the blastoderm is ready for dehydration by alcohol, and mounting in the usual manner in balsam, or better in three parts pure Canada balsam mixed with one part d'Ammar varnish, as furnished by the microscopical dealers.

Embryos mounted in this way make very perfect preparations, surpassing, indeed, those otherwise treated.

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SCIENTIFIC NEWS.

— The method of teaching elementary botany at the Michigan Agricultural College, by Professor W. J. Beal, seems to us to be so excellent, that we extract the following reference to it in his address, entitled "Our Agricultural Colleges," given to the Connecticut Board of Agriculture, in 1880, and which has just been printed:

"Before the first lesson each pupil is given some specimen to study. If flowers or growing specimens cannot be had, give each a branch of a tree or shrub, which branch may be two feet long. The examination of these is made during the usual time for preparing lessons, and not in the class room. Without having the specimen in sight, they are to tell what they can about them for the next recitation. They can use books if they prefer, though it is better that they do not. No books can be found that will give much assistance on such a lesson. The time arrives, and the hour is mostly spent in hearing different members report their discoveries, until all have had a chance to add anything not noticed by any other member. The teacher suggests a few other points for study. The pupils are not told about things which they can see for themselves. An effort is made to keep them working after something which they have not discovered. If two members disagree on a point, on the next day, after further study, they are requested to bring in all the proofs they can to sustain their separate conclusions.

"It is often astonishing to notice how much is discovered by so many good eyes. For the next lesson the students review the first lesson, report on a branch of another kind of plant which they have studied, and notice the points of difference and similarity between the two. In like manner new branches are studied and new comparisons made.

"For some weeks but little use is made of microscopes or text-books. In nearly all important cases specimens are examined, and a need felt for a name or a definition before these are given. After a few lessons answers to the following points are brought out:

"Is there any definite proportion of active to dormant buds in any year? Where do branches appear? Is there any agreement in growth as to length of branch and size of the annular ring each year? Is there any similarity of rapid or slow growth of all the limbs on a branch in each year? Is there any certain number of leaves on a year's growth, or any definite proportion between the length of internodes? Can the smallest, old, dormant buds be made to grow? Is there any order as to what buds grow and what remain dormant? How much and on what years did each limb grow? There are three ways of telling the age of a branch—by the bud-rings, stem-rings and color of the bark. The shape, other peculiarities, and variations of buds, and leaf-scars in any species are noted; also the arrangement and position of the buds and bud-scales. Is there any order in the arrangement of the specks on a branch? Do the specks change as the branch grows older, and if so how? How many leaves each year were required to build up the branch? How large were the leaves and the amount of surface exposed? Did the amount of growth in any year correspond to the number of leaves on the twigs and main axis? Does the ring of wood depend on the growth of the main axis? The arrangement of the scales of cones are studied in this connection. In each case the students are requested to try to classify the topics or place them under proper headings. They are now ready for a book lesson on branches, buds and phyllotaxis, and they will read it with interest and profit.

"In like manner any other topic can be taken up, provided plenty of specimens can be supplied, as roots, seeds, fruits, stamens, petals, sepals, leaves, etc. After each of these comes the study of the book. Beginners should study plants and refer to books, and not study books and refer to plants.

"Some of the above topics are admirably well adapted for theses or compositions. I usually give each student one or more of them each term. For the younger students this year, the following topics will serve as examples: 'Compare the leaves and young branches of the Scotch pine with those of the Austrian pine,' or 'black spruce and Norway spruce,' or 'sugar maple and red maple,' or 'butternut and black walnut.'

"As students advance in systematic botany and morphology, other subjects for theses are assigned, of which the following may serve as examples:

"The arrangement and development of parts of the flower, with reference to its self-fertilization, or fertilization by insects, birds, winds, or by other means. Below are samples: Moth-mullein, dog-bane, common sage, thyme, red clover, plantain, milkweed, mallow, thistle, cleistogamous flowers of violet, campanula, iris, lobelia, martynia, Indian corn, wild balsam. One student may study the vines of dodder; one, the climbing of Virginia creeper; one, the twining of the wild morning-glory; one, cucumber tendrils; one unequal-lobed leaves; one, the time of opening and closing of flowers; several, the development of some irregular flowers; one, the order of dehiscence among anthers of a flower; one, the honey-glands of some flower; glands in other parts of plants than flowers; growing beans in all sorts of soil and with more or less light; the germinating power of weevil-eaten peas; the relative order of development of stamens and pistils of many plants of Indian corn; for what do ants visit plants?

"The theses were made up of original investigation and experiments, and were read in class. Students use stage microscopes. Later in the course, each is supplied with a good compound microscope, in a suitable room, where he works daily for a term. Pupils prepare their own slides, make notes and drawings, which are preserved at the college. Most of the time for the term is spent on one plant, a favorite of which is the common pumpkin."

— The British Association began its meetings Wednesday, Aug. 31, at York, when Professor A. C. Ramsay, Director-General of the Geological Survey of the United Kingdom, and of the Museum of Practical Geology, resigned the chair; and Sir John Lubbock, president-elect, assumed the presidency, and delivered an address. On Thursday evening there was a soirée in the assembly-rooms and concert-rooms. On Friday evening Professor Huxley discoursed on the "Rise and Progress of Palæontology." On Saturday evening Professor Osborne Reynolds, F.R.S., delivered a popular lecture to the working classes. On Monday evening Mr. Spottiswoode, president of the Royal Society, gave an address on the "Electric Discharge, its forms and its functions." On Tuesday evening there was a soirée. On Wednesday, September 7, the concluding general meeting was held at 2.30 P.M.

—The *Penn Monthly* for August contains an excellent biographical notice of the late Professor S. S. Haldeman, by Professor C. H. Hart. Among recent deaths of scientists we have to chronicle that of Dr. Ferdinand Keller, the distinguished Swiss archæologist and author of a well known work on Lake dwellings. He died at Zurich, July 21, aged 80 years. A prominent English botanist, H. C. Watson, born in 1804, and author of several works, including "Cybele Britannnica," died in July. Dr. Phil. de Rougemont died at Neuchatel, May 27.

— Among recent Bulletins of the Census are the statistics of the fisheries of the Great Lakes for 1879, prepared by Mr. F. W. True from notes furnished by Mr. Ludwig Kumlien; the total value is $1,784,050. The production of anthracite coal in Pennsylvania for 1880 was 27,433,329 tons, a gain of 75.9 per cent. over 1870. The production of salt was a little less in 1880 than in 1870. Of cotton 5,737,257 bales were produced in 1880, Mississippi producing most, Georgia being the next heaviest producer.

— Professor Snow of the University of Kansas and his party, recently had a narrow escape from death, at the hands of the hostile Apache Indians, in New Mexico. They were besieged for three days in the water cañon of the Magdalena mountains, and made their escape on foot to Socorro, after concealing their personal property. On the road they passed a party of freighters lying dead beside their wagons, victims of the Indians' murderous propensities.

— Two of the parties of the U. S. Geological Survey under Major J. W. Powell, are at Fort Wingate, N. Mex. These are under the immediate direction of Messrs. Thompson and Gore. Mr. and Mrs. James Stevenson, of the same survey, are also there, preparing for an investigation into the archæology and ethnology of the surrounding region. There is some risk that the operations of these parties will be interfered with by the hostile Apaches.

Carlile P. Patterson, Superintendent of the U. S. Coast Survey, is dead. His successor has not yet been appointed, but it is anticipated that it will be Julius E. Hilgard, for a long time the able second officer of the survey.

— Mr. G. Brown Goode has been appointed, by Professor Baird, Curator of the National Museum, Washington. An excellent appointment.

— The German Association of Naturalists and Physicians was to hold its meetings at Salzburg from Sept. 17 to 24.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Association for the Advancement of Science.—The thirtieth meeting was held at Cincinnati, Aug. 17–23, 1881. The meeting was as largely attended as any ever held except the last (Boston) meeting, and everything was done by the hospitable citizens of Cincinnati to render the session pleasant and profitable. The next meeting will be held at Montreal. Dr. J. W. Dawson, of Montreal, was elected president, and William Saunders, Esq., of London, Canada, general secretary, for the next year.

Following are the titles of papers read on biology, geology and kindred sciences:

On the ancient Japanese bronze bells. Edw. S. Morse.
On changes in Mya and Lunatia since the deposition of the New England Shell-heaps. Edw. S. Morse.
On worked shells in New England Shell-heaps. Edw. S. Morse.
Natural and industrial history of the White Pine in Michigan. Wm. Hosea Ballou.
Phenomena of growth in plants. D. P. Penhallow.
On the life duration of the Heterocera (moths). J. A. Lintner.
On the length of life of Butterflies. W. H. Edwards.
How does the Bee extend its tongue. A. J. Cook.
The Syrian Bees. A. J. Cook.
Carbolic acid as a preventive of Insect ravages. A. J. Cook.
On certain habits of *Heliconia charitonia*. W. H. Edwards.
Historic notes on Cosmic Physiology. T. Sterry Hunt.
The uncivilized mind in the presence of higher phases of civilization. Otis T. Mason.
The best method of mounting whole chick embryos. Charles Sedgwick Minot.
Note on whether man is the highest animal. Charles Sedgwick Minot.
Note on the segmentation of the vertebrate body. Charles Sedgwick Minot.
The motion of roots in germinating Indian corn. W. J. Beal.
Exhibition of some archæological specimens from Missouri. S. H. Trowbridge.
Animal myths of the Iroquois. Mrs. Erminnie A. Smith.
A remarkable invasion of Northern New York by a Pyralid insect (*Crambus vulgivagellus*). J. A. Lintner.
Recent discoveries, measurements and temperature observations made in Mammoth Cave, Ky. H. C. Hovey.
A remarkable case of retention of heat by the earth. H. C. Hovey.
Coal dust as an element of danger in mining; shown by the late explosion in the Albion mines in Nova Scotia. H. C. Hovey.
A revision of the anatomy of the ethmoid bone in the Mammalia. Harrison Allen.
The life unit in plants. Byron D. Halsted.
On *Bopyrus manhattensis* from the gill-cavity of *Palæmonetes vulgaris* Stimpson. Carl F. Gissler.
The stone images and idols of the mound-builders. Wm. McAdams.
Some remarkable relics from the mounds of Illinois. Wm. McAdams.
Stone implement showing glacier marks. Wm. McAdams.
The occurrence of Cretaceous fossils near mouth of Illinois river. Wm. McAdams.
Mound-builders' skeletons. Watson C. Holbrook.
Stone implements in the drift. Watson C. Holbrook.
Prehistoric hieroglyphics. Watson C. Holbrook.
A contribution to Croll's theory of secular climatal changes. W. J. McGee.
Influence of forests upon streams. David D. Thompson.
Mineralogical Notes. Benjamin Silliman.
On the influence of the structure of the nerve-fibres upon the production and conduction of nerve-force. H. D. Schmidt.
The recurrence of faunas in the Devonian rocks of New York. H. S. Williams.
Note on some fish remains from the Upper Devonian of New York. H. S. Williams.
Some phenomena in the conjugation of the infusorium Actinophrys sol. J. D. Cox.
Note on specimens of Ptilophyton and associated fossils collected by Dr. H. S. Williams in the Chemung shales of Ithaca, N. Y. J. W. Dawson.
A contribution to the study of Bacterial Organisms, as commonly found on exposed mucous surfaces and in the alimentary canal of healthy individuals. Geo. M. Sternberg.
On recent deep-sea soundings in the Gulf of Mexico and Caribbean sea, by the U. S. Coast Survey. J. E. Hilgard.
A new and improved freezing Microtome. Thomas Taylor.
Bacteria and Micrococci, and their relations to plant culture. Thomas Taylor.

The Berea Grit of Ohio. Edward Orton.
The Gold-bearing drift of Indiana. Geo. Sutton.
On the amount of Glacial erosion in Ohio, Indiana, and Illinois, with some deductions therefrom. E. W. Claypole.
On the discovery of an Archemediform Tenestellid in the Upper Silurian rocks of Ohio. E. W. Claypole.
Life-history of the Buckeye Stem-borer (*Sericoris instrutana* Clem.) E. W. Claypole.
Some needed reforms in the use of Botanical Terms. Charles E. Ridler.
The excavation of the Grand cañon of the Colorado river. C. E. Dutton.
On the cause of the arid climate of the far West. C. E. Dutton.
Evolution and its place in Geology. Edward S. Edmunds.
The evidence from the Drift of Ohio in regard to the origin of Lake Erie. E. W. Claypole.
A short study of the features of the region of Lower Great Lakes during the Great River age; or notes on the origin of the Great Lakes of North America. J. W. Spencer.
On the inhabitants of N. E. Siberia, commonly called Chukchis and Namollo. W. H. Dall.
A lawgiver of the Stone age. Horatio Hale.
Ilex cassina, the black drink of the Southern Indians. John G. Henderson.
Was the antelope hunted by the Indians on the prairies of Illinois? John G. Henderson.
Agriculture and agricultural implements of the ancient inhabitants of the Mississippi valley. John G. Henderson.
Houses of the ancient inhabitants of the Mississippi valley. John G. Henderson.
Comparative differences in the Iroquois group of dialects. Mrs. Erminnie A. Smith.
Typical thin sections of the rocks of the Cupriferous series in Minnesota. N. H. Winchell.
The limited biological importance of synthetic achievements in organic chemistry. Albert B. Prescott.
Retarded development in Insects. C. V. Riley.
New Insects injurious to American agriculture. C. V. Riley.
The egg-case of *Hydrophilus triangularis*. C. V. Riley.
On the oviposition of *Prodoxus decipiens*. C. V. Riley.
The cocoon of *Gyrinus*. C. V. Riley.
Ozark highlands. G. C. Swallow.
On the disposition of color—markings of domestic animals. Wm. H. Brewer.
On a mesial cusp of the deciduous mandibular canine of the domestic cat, *Felis domestica*. Burt G. Wilder.
Remarks on the classification and distribution of Producti. S. H. Trowbridge.
The temperature of North German Traps at the time of their extrusion. H. Carmichael.
Recent existence of sword-fish, shark and dolphin in the fresh-water pond near Buffalo, N. Y. Wm. Zimmerman.
Antiquity of Man in America. W. De Haas.
Progress of Archæological Research. W. De Haas.
The Mound Builders; an inquiry into their assumed southern origin. W. De Haas.
Additional facts on the fertilization of Yucca. Thomas Meehan.
On the interpretation of Pictographs by the application of gesture-signs. W. J. Hoffman.
An alleged abnormal peculiarity in the history of *Argynnis myrina*. W. H. Edwards.
On a convenient form of slide case. Robt. Brown, Jr.
On some relations of Birds and Insects. S. A. Forbes.
Comparison of Maya dates with those of the Christian era. Cyrus Thomas.
Notice of a Fern indigenous to California, but heretofore considered as an introduced hothouse species. Mrs. Leander Stone.
Fossil teeth of Mammals from the Drift of Illinois. Wm. McAdams.
The Unification of geological nomenclature. Richard Owen.

MIDDLESEX INSTITUTE, Malden, Mass., June 17.—The annual field meeting of the institute was held on Bear hill, in the Middlesex Fells, Stoneham. A large number of guests were present, and the day passed enjoyably. Many plants not previously collected were added to the list of our county flora, and Mrs. P. D. Richards found that rare plant, *Habenaria hookeri.*

June 22.—An exhibition of native plants from Malden, Medford and other parts of the county, was held in Institute Hall, and attracted a large number of visitors.

July 27.—A special exhibition of the native ferns of Middlesex county was given with gratifying success. Mr. Frohock exhibited *Woodwardia angustifolia* from Medford, Mass., found for the first time within the limits of Middlesex county, and Mr. Dame exhibited *Botrychium matricariæfolium* from Stoneham.

Arrangements are partially completed for a course of scientific lectures to be delivered during the winter months.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

Quarterly Journal of Microscopical Science, July.—On the lymphatic system of the skin and mucous membranes, by E. Klein. The development of the water glands in the leaf of *Saxifraga crustata*, by W. Gardiner. The development of the Spermatozoa, Part II. Helix and Rana, by J. E. Blomfield. On the early development of the anterior part of the wolffian duct and body in the chick, together with some remarks on the excretory system of the Vertebrata, by Adam Sedgwick. Observations on the cranial nerves of Scyllium, by A. Milnes Marshall. On the occurrence of corpuscles in the red vascular fluid of Chætopods, by J. E. Blomfield. Pacinian corpuscles in the pancreas and mesenteric glands of the cat, by V. Harris. Limulus an Arachnid, by E. R. Lankester.

The Geological Magazine, August.—On the Archæan rocks, by C. Callaway. The Megaceros in Ireland, by W. Williams. The glaciation of the Shetlands, by B. N. Peach and J. Horne.

Annales des Sciences Naturelles, June.—Monograph of the birds of the family Megapodiidæ, by E. Oustalet, 2d part. New researches on the organization and development of Gordiacea, by M. Villot. Description of macrurous Crustacea from great depths of the seas of the Antilles, by A. Milne Edwards.

Jenaische Zeitschrift fur Naturwissenschaft, July 31.—On the muscles of the eye of Ganoids, by H. Schneider. The mouth-arms of Rhizostomæ and their appended organs, by O. Hamann. The development of the middle germ-layer of vertebrates, by O. Hertwig.

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ON THE MICROSCOPIC AND GENERAL CHARACTERS OF THE PEACH TREE AFFECTED WITH THE "YELLOWS."

BY W. K. HIGLEY.

SYMPTOMS OF THE YELLOWS.

1. *Premature Ripening.*—This symptom is one of the most common, although it is not by any means always noticed. In many cases it is very marked. During my investigation I have corresponded freely with persons upon this subject, and many have stated that this is only a marked symptom in certain varieties, prominent among which is "Stanlie's late." Mr. John Williams, of South Haven, sent me specimens of this variety that ripened three weeks before the proper time. This symptom is not wholly confined to the peach affected with the yellows, as it is also said to be produced by the borer and curculio, but from all the evidence that I have been able to glean, I think that it can be safely stated that it is an infallible symptom when noticed in some localities. I cannot agree with those who state that this symptom is only noticed in certain varieties, but think that although it may not always happen, yet when it does it is just as liable to be on one variety as another. It is, at all events, a thing to be looked after when the presence of this disease is feared.

2. *Color of the Peach.*—I have noticed particularly that affected peaches, when opened, presented a very abnormal appearance as to the position, extent and size of the pigment spots. In the normal fruit bright red spots are often present near the pit and, perhaps, even toward the outer portions of the cellular part,

while in the diseased fruit, especially that which has prematurely ripened, near the pit considerable red coloring matter may be noticed, often in a conglomerate mass, and scattered through the remainder of the fleshy portions many oblong or rounded masses of the same color. Under the microscope these appear to be simply cells filled with a coloring matter that may be removed by treating with strong potassic hydrate, acetic acid, or alcohol. The skin of the peach also shows a highly abnormal color, generally simply spotted with red, but in some specimens that I have had the opportunity of examining, this red color assumed an oblong shape, the spots being arranged in bands. This symptom seems to be of the highest importance, as there is no other disease, so far as I am able to ascertain, that will produce the above results.

3. *Production of Abnormal Branches.*—Perhaps one of the most marked symptoms of the yellows is the abnormal production of branches, or rather branchlets. But the pomologist must guard against one important fact in diagnosing the yellows from this symptom, viz., *the production of numerous twigs.* Non-cultivation of any domesticated tree will often cause a great abundance of small twigs or shoots to grow from the secondary branches; they may continue as high as the sixth division into branches. Again a great proficiency of twigs may be produced by the use of much rich manure year after year. However, to return to the discussion of branchlets as an indication of the yellows, let it be remembered that it is the branchlets and not the twigs that are of importance. These are produced on the main or larger branches from lateral buds, and in some cases even from the trunk of the tree. They are slender wire-like shoots, often no larger than a needle, from two to eight inches long, and not seldom showing a tendency to throw out lateral or secondary shoots. They may attain to a much greater length, but, as far as I can ascertain, the above measurements form a good average. This peculiar feature of the disease is easily explained. A spore of the fungus falling upon some part of the branch, finds the conditions favorable for development and sends out its mycelium which ramifies through the tissues of the limb and soon fills up the passages, crowding the vessels and cells so that the flow of sap to the parts beyond this point is nearly stopped; thus the ends of the growing branches being choked, the sap is caused to flow to the lateral buds, and these having so plentiful a supply of nutriment, grow

rapidly and throw out these wire-like shoots. This symptom, with the one previous, are sure and infallible guides to the detection of the yellows; they often occur together, but more often the former is the second stage, only appearing after the latter has been present the year previous. I examined carefully several specimens of these branchlets, and in two-thirds of them I found the mycelium of a fungus in the tissue. Those in which the fungus was present were from South Haven, the remainder from other localities showed no signs of mycelial growth. It is very probable, however, had time permitted extended sectional examinations, that I should have found, even in these, evidences of parasitical forms.

4. *Microscopical Symptoms.*—There are many marked peculiarities noticed when sections of the different parts of a tree are studied, but whether or not some of these will be produced by other causes than the yellows, is a subject too patent to need any discussion. One of the most important points noticed in microscopical examination, is the *loose character of the cells* and other parts of the section, both transverse and longitudinal. This would only be noticed by one who has carefully compared both sections of the healthy and unhealthy tree. I was very much surprised when I first noticed this condition of things, and hoping that it might give me some clue to the cause of the disease, I examined several more specimens, but with no important results, except that it was a constant character of the diseased specimens that I had; it appeared in sections of the root as well as in those of the aërial portions. Attention may be called also to the sheets of mycelia that are sometimes found between the layers of wood as probably another symptom. Some of the many investigators who attribute the yellows to a fungoid growth, consider this as very marked evidence of the yellows, but it is not near so marked as is the abnormal coloring matter noticed in the pith. In the specimens of the wood of diseased trees that I have been permitted to examine, the most prominent microscopical symptom was the decided separation of the annual growths of wood; in the space thus formed no structure was visible, although apparently filled with some material, perhaps the ends of mycelia. I found it quite difficult to make sections of the diseased limbs and other parts of the aërial portions of diseased trees, for, on account of this loose structure, the cells, especially of the bark, were

easily displaced, thus showing that one effect of the disease is a tendency toward *disorganization.* How far this character may extend, I am unable to say, but it was very marked in all the specimens sent me. I was unable to make thin sections for study until the parts were soaked in strong alcohol or chromate solution for some time. I am informed that a gentleman, whose name I am not able to obtain, claims that in nearly all the sections of diseased specimens that he examined, he noticed that a great number of the cells of the pith and inner bark and many of those of the woody portions were ruptured and completely disorganized. Although I have examined a number of sections, looking carefully in each for ruptured cells, I have not been able to find any. Therefore I can only give the above statement on authority not being able to sanction it by my own work. I have no doubt that some one or more very important microscopical symptoms may be found, on the comparison of more specimens from many localities, that are not enumerated above.

5. *Appearance of the unmagnified Section.*—A section of the trunk of a tree, well along in years, shows peculiarities to a marked degree. One first notices the yellowish color which pervades the whole section, with the rings marking the annual growths of a darker color, perhaps a light brown, and then the dark spots scattered through the woody portion. It very forcibly reminds one of a bilious state of the system. A section of the root presented nothing abnormal to the naked eye.

6. *Appearance of the Leaves.*—The leaves upon the diseased branches have a general sickly appearance, are of a pale color and more or less dried. Especially are the leaves of the abnormal shoots or branchlets characteristic; these are pale and often more or less curled. There seems to be a greater number of leaves than is normal, upon diseased trees, especially before it has lost the greater part of its vitality. This is not to be wondered at, as the leaves are really the lungs of the tree, the green matter acting the part of an absorbent. If now several of the branches become diseased and the leaves lose their power to act, it seems natural that in order to obtain that nutriment necessary for vitality, assigned to the leaves, more leaves would be formed upon the healthy portions of the tree. Soon there has been so much of the nutriment of the tree used to overcome this gasping caused by the diseased branches, whose trouble is steadily advancing to

other branches, that but little is left to form the fruit, and thus the peaches grow smaller and fewer in numbers after the first premature ripening until the tree dies!

As so many other causes, as a direct effect, produce a diseased condition of the leaves, they can hardly be accepted as a true symptom of the yellows, unless in connection with other marked indications.

Perhaps I have said more upon the symptoms of the yellows than many would consider necessary, but it is well known that the physician diagnoses a disease from the symptoms, and then looks for that which will produce the cure. In plain words, the indications give him a clue to the cause and what will afterwards be essential for the cure. To this end I desire to call forth from the *practical and scientific fruit growers* a report of what they have noticed, whenever it has been their privilege to observe the symptoms and action of this disease, hoping that I may glean from these reports something that may guide us in our work.

Nearly every species of parasitical fungi has its special host, often carrying this so far as to refuse to grow upon a closely-allied species or variety. Many others will grow upon allied hosts provided the true host is removed. But this does not seem to be the case with the fungus that we are dealing with at present; it is characteristic of the peach alone. Hill's Chili seems to suffer the most, but still it clings to other varieties just as tenaciously when once introduced into an orchard. There is no doubt but that we can safely say "*no variety is exempt.*"

SOIL AND PREVENTIVES.

Does the soil have any effect upon the yellows? In answer to this question, I should say, *directly no; but indirectly it does.*

I am quite positive that if the orchard is kept in the proper state of cultivation it will not be as apt to contract the disease, although I cannot say that this is a preventive in the face of all the evidence to the contrary. It is a well known fact, however, that if the digestive, circulatory and respiratory organs in man are in their proper state, there is not near as much danger of the body contracting a disease. I believe that this is, to a great extent, also characteristic of the vegetable kingdom. Thus the right food and care, or in plain words the right cultivation, fertilization and pruning, may, to a great extent, aid the pomologist in his warfare against the yellows. On the other hand, lack of care in cultivation, etc., may reduce the tree to such a condition that it becomes susceptible to disease, and is more liable than in the first case to catch this troublesome malady.

Downing says,[1] "Let us look for a moment into the history of the peach culture in the United States. For almost an hundred years after this tree was introduced into this country, it was largely cultivated, especially in Virginia, Maryland and New Jersey, as we have already stated, in perfect freedom from such disease [the yellows], and with the least possible care. The great natural fertility of the soil was unexhausted, and the land occupied by orchards was seldom or never cropped. Most of the soil of the States, however, though at first naturally rich, was light and sandy, and in course of time became comparatively exhausted. The peach tree, always productive to an excess in this climate, in the impoverished soil was no longer able to recruit its energies by annual growth, and gradually became more and more enfeebled and short lived."

I have great regard for the opinion of practical experimenters and investigators—the horticulturists of our country—but looking at the matter from a scientific standpoint, I must confess that I firmly believe that if great care be exercised in cultivation, pruning, etc., the fruit grower will be greatly aided in reducing the spread of this disease.

I can but agree with Professor Kedzie when he says, "I think the trees lack potash and phosphoric acid." These may be applied in cultivation by mixing them, either separately or combined, with the earth around the base of the tree where they can be absorbed by the roots; or superphosphate of lime and ashes may be used.

The subjects of cultivation and the preservation of the trees and the prevention of this disease by this means, belong rather to the practical investigator than to the microscopist or chemist, for we, working with our microscope and test-tube, can only suggest and theorize, while the experiments must be left with those who raise the trees. In concluding these remarks, I am glad to be able to say that many are carefully experimenting and noting their observations and results.

[1] "Fruits and Fruit Trees of America," eighth edition, p. 464.

HISTORY.

A few of the statements made above led me at this point to consider the history of this disease.

It is one of the oldest tree diseases on record in this country. It seems to have first appeared in the Atlantic States, or near that region. It does not seem to have been imported, as there is no record, as far as I can ascertain, of its ever occurring in the old world before its presence was detected here; and, moreover, the only note that I have noticed of its presence in Europe, stated that it was brought from this country in the pits, and the trees raised from them showed symptoms of the yellows and soon died.

"About 1800, or a few years before, attention was attracted in the neighborhood of Philadelphia to the sudden decay and death of orchards without apparent cause. From Philadelphia and Delaware the disease gradually extended to New-Jersey, where, in 1844, it was so prevalent as to destroy a considerable part of all the orchards. About three or four years later it appeared on the banks of the Hudson (or from 1812 to 1815), gradually and slowly extending northward and westward, to the remainder of the State. Its progress to Connecticut was taking place at the same time, a few trees here and there showing the disease until it became well known (though not yet generally prevalent) throughout most of the warmer parts of New England."[1]

Downing continues with many remarks confirming further what has been said under the action of the soil and preventives. For this reason I shall quote still further from his work:[2]

"It should be here remarked that, though the disease had been considerably noticed in Maryland and Middle States previously, yet it was by no means general until about the close of the last war. At this time wheat and other grain crops bore very high prices, and the failing fertility of the peach orchard soils of those States was suddenly still more lowered by a heavy system of cropping between the trees, without returning anything to the soil. Still the peach was planted, produced a few heavy crops, and declined, from sheer feebleness and want of sustenance. As it was the custom with many orchardists to raise their own seedling trees, and as almost all nurserymen gathered the stones *indiscriminately* for stocks, it is evident that the constitutional debility of the parent tree would naturally be inherited to a greater or less degree by the seedlings. Still the system of allowing the tree to exhaust itself by heavy and repeated crops in

[1] "Fruit and Fruit Trees of America," p. 464.
[2] Page 464.

a light soil was adhered to, and generation after generation of seedlings, each more enfeebled than the former, at last produced a completely sickly and feeble stock of peach trees in those districts.

"The great abundance of this fruit caused it to find its way, more or less into all the markets on the sea-coast. The stones of the enfeebled southern trees were thus carried north, and, being esteemed by many better than those of home growth, were everywhere more or less planted. They brought with them the enfeebled and tainted constitution derived from the parent stock. They reproduced almost always the same disease in the new soil and thus, little by little, the yellows spread from its original neighborhood, below Philadelphia, to the whole northern and eastern sections of the Union. At this moment it is slowly but gradually moving west, though the rich and deep soils of the western alluvial bottoms will, perhaps, for a considerable time, even without care, overpower the original taint of the trees and stones received from the east."

As to the appearance of the yellows in New Jersey, I will quote again:[1]

"A gentleman to the peach 'manor born,'—in Monmouth county, N. J.—but who has resided in this vicinity during the past ten years, informs us that he has witnessed the destruction of the peach orchards in these localities during the past thirty years. First in Monmouth county, about 1850, the yellows made its appearance, and culminated in the destruction of the peach orchards about 1856. Monmouth county and vicinity were famous in their day, having often glutted the eastern markets with peaches. Driven from the Atlantic coast counties by the yellows, the prominent peach growers of New Jersey located in Morris and other counties in the north of the State, where peaches were grown successfully until about 1867, when New Jersey peach growers were again driven by the yellows to 'fresh fields,' favorable localities in Delaware and Maryland being chosen, from whence the eastern markets have received their principal supplies during the past few years. Incipient signs of yellows have appeared in Delaware and Maryland, and it is evident that a 'change of base' will soon become necessary."

In the same volume it says: "The first record of the peach yellows is found in the *Genesee Farmer*, and was published about forty-five years ago. The disease as it now exists was accurately described. The Farmers' Book, which was compiled and printed at Chambersburgh, Penn., Sept. 16, 1845, contains a communication from Sidney Weller, Halifax county, North Carolina." So

[1] Michigan Pomological Report, 1878, p. 256.

it seems that previous to 1845 it had been detected in North Carolina.

The disease appeared in Michigan about 1857; the exact time is not known, nor by what method it was introduced. To my knowledge it has not been reported in Ohio or Indiana. If this be true it is a query how it got to Michigan unless imported in the fruit or young trees brought from nurseries in infected districts. This I believe to be the case, and have a faint recollection of seeing a published statement to that effect.

The orchards of the South Haven district seem to have been the first to suffer.

From the above facts of history, it will be seen that this disease is one that progresses slowly, and yet in one sense rapidly, and is as sure in its results as is pulmonary consumption. It is to be hoped that such active measures shall be taken that its future history shall not cover near as much territory as at the present time. It is a disease that, unless checked in its progress, will follow wherever civilization advances.

[*To be continued.*]

——:o:——

ON THE SO-CALLED CHUKCHI AND NAMOLLO PEOPLE OF EASTERN SIBERIA.[1]

BY W. H. DALL.

THE natives of that portion of Asia lying east of the meridian of 180° from Greenwich, and between Behring sea and strait and the Arctic ocean, have always been regarded with particular interest. This interest arises partly from the fact that they alone of all the Siberian tribes have maintained their independence of Russian authority, and partly from the idea that these people form a link between the races of Asia and America; a thorough knowledge of their ethnological position being supposed to be all that was required to confirm or disprove certain theories of migration.

Another source of interest is the confusion that has always existed in regard to their division into different stocks, and which is still far from being cleared away. The forthcoming work of Lieut. Nordqvist, of the *Vega* Expedition, will doubtless afford

[1] Read before the American Association for the Advancement of Science, Cincinnati, 1881.

means of rightly locating a part of these people and the rest will doubtless be cleared up before many years by new investigations.

F. von Stein, in *Petermann's Mittheilungen*,[1] has recently given an interesting résumé of the information in regard to these people contained in articles by Nordqvist and Hovgaard in the Isvestia[2] of the Russian Geographical Society; among others who have contributed some information on the subject, most of whom are referred to by Stein, are Wrangell,[3] Neumann,[4] Maydell[5] (or Maidel), Kennan,[6] Bush,[7] Stimpson,[8] Professor Asaph Hall[9] and Dall.[10] Others, to whom I have seen no reference made, are Shismareff[11] and an unknown writer in the Journal of the Interior Department[12] of Russia, both articles being in the Russian language.

In a summary of our work for the season of 1880 (being an abstract of a letter from me describing my third visit to the coast of Northeast Siberia), contained in the January number of the Royal Geographical Society's Proceedings, this paragraph occurred:

"It was remarked that the proper name of the people on the Asiatic side described by Nordenskiold and his companions, and previously by Hooper[13] and Mr. Dall, is Yū'-it, a corruption or shortening of In-nū-it (Eskimo), of which they merely form one tribe. They are totally distinct in language, race and manners from the so-called Reindeer Chukchis *(Tsau'-yū-at)*, who are a mere tribe of the Korak nation."

To this somewhat ambiguous and not literally exact statement, Lieut. Nordqvist has taken exception in a communication to the

[1] 1881, Heft II, pp. 41–45.

[2] Band XVI, Heft II, 1880.

[3] Narrative of an expedition to the Polar sea (Sabine's ed.). 8vo. London, 1840 (p. 126). Cf. also The Telescope, 1835, No. 26.

[4] Hist. Ubers. Tschuktschen Exp.; Isv. Sib. Abth. Russ. Geogr. Soc. Vol. I, Nos. 4–5, II, No. 3, 1871.

[5] Antworten der Tschuktschen Exp.; Isv. l. c. II, Nos. 1 and 2, pp. 60–70; 1871.

[6] Tent Life in Siberia, etc. 12mo. New York and London, 1870. (p. 120.)

[7] Reindeer, dogs and snowshoes. 8vo. Harper Bros., 1871. (p. 426.)

[8–9] Cf. Alaska and its Resources, pp. 549–554.

[10] Alaska and its Resources, Boston, 1870, pp. 374–385. Also, Contr. to Am. Ethnology (J. W. Powell), I, pp. 12–15, 93–106, 1877. Also Proc. Roy. Geogr. Soc., Jan., 1881, pp. 47–49; Sept., 1881, pp. 568–570.

[11] Zapiski Hydr. Dept., X, pp. 178–200, 1852.

[12] Zhurnal Minist. Vnutr. Diel, 8vo, St. Peterbuorg, 1835, XVI, 5, and 1851, Nos. 6–7.

[13] Ten months among the tents of the Tuski, etc., 8vo, London, J. Murray, 1853.

Imperial Geographical Society of St. Petersburg,[1] which I have not seen, but which is summarized in a note in the Royal Geographical Society's Proceedings for June, 1881.[2] According to the editor, Lieut. Nordqvist's observations are as follows:

"According to Lieut. Nordqvist the stationary and nomad Chukchis both belong to the same race, and call themselves in the singular 'Chau-chau,' and in the plural 'Chau-chau-ate.' These people, he says, live to the north of Cape Chukotsky, and must not be confounded with the true Eskimo who live to the south of it, chiefly on the shores of the Gulf of Anadyrsk, as far as Cape Oliutorsky, a fact which Lieut. Nordqvist urges, is incontestably proved by a comparison of the idioms in the languages of the two peoples."

While not holding Lieut. Nordqvist responsible for the literal words of the above note, it was evident that some misapprehensions entered into his suppositions concerning the people on the coast referred to, as well as some errors of my own to be corrected. This called my attention to the subject, and induced me to overhaul my notes and look up the Russian literature of the subject, trusting that to Lieut. Nordqvist's valuable investigations in regard to the people on the north coast of Siberia, west of East cape, some facts might be added in regard to those on the eastern and southern shore of the same great peninsula.

On the Siberian coast south and west from East cape, the *Vega* spent less than a day at St. Lawrence bay, and little more than a day and a half at Konyam bay, a length of time insufficient to give to the members of the party more than a cursory glimpse of the people, without affording any ground for positive statements; as indeed is frankly admitted by these gentlemen (according to Stein's digest of their publications), who express themselves with due reserve in regard to the ethnological problems of this section of the coast.

The summary of the season's work was written by me while on the voyage home, having then seen only Palander's narrative, which appeared in the *Scientific American Supplement*, Nos. 231 and 232. There being little doubt that at some former time the Eskimo had occupied the north coast of Siberia as far west as Koliuchin bay; the description of the manners and customs given by Palander of the dwellers on that coast agreeing precisely with

[1] Published in its Bull. fascic. II of 1881.

[2] l. c. p. 36.

those of the Eskimo tribes further south; and the few words given of their language belonging, at least in part, to the jargon spoken by both Eskimo and Korak (or Chukchi) in communication with the whites and with each other, it was not all unnatural to suppose that the winter neighbors of the *Vega* were Eskimo (or, as formerly distinguished, sedentary Chukchis) similar to those with whom I had had personal intercourse.[1]

The observations of Lieut. Nordqvist must be taken as conclusive in relation to the people with whom he was brought in contact. Hence we must conclude that at the present day the inhabitants of the region on the north coast of Siberia, west from East cape and as far as Cape Shelagskoi, belong to that branch of the Korak nation which form the original genuine Chukchi of the early Russian explorers. They are, however, not the wandering or reindeer Chukchi, but that part of the nation which gain their living by sealing and fishing. The *Vega* party were visited by reindeer Chukchi, during the winter, repeatedly; some from the vicinity of Behring sea appearing on two occasions, but in Stein's paper no reference is made to any comparison between them and the fishing Chukchi, by which the differences in life and manners might be made clear. The names Chukchi, sedentary Chukchi, etc., have been used in such a confused manner that they no longer have any clear signification, and it is desirable that they should be discarded entirely. For instance, in speaking of sedentary Chukchi, I should refer to the Eskimo of N. E. Siberia, to whom that appellation has generally been misapplied, but Lieut. Nordqvist would understand the north coast people of his wintering place, to whom it more properly belongs. It will, therefore, be advantageous to preface any discussion of the different branches by a synonymy which will show what is meant by any particular name. For the real, original wandering Chukchi, who live by their reindeer and by summer fishing, the name of

[1] Of the twenty-three words given in Palander's account (as printed in the cited work) three were Eskimo or corrupted Eskimo; seven were recognized as similar to words having the same meaning of the Chukchi (reindeer men) of the vicinity of Plover bay; one (certainly, and probably two) is of Hawaiian origin, and is in use on both sides of Behring sea among all the people who have had intercourse with whalers and traders from the Sandwich islands; another is a corrupted Russian word; the rest were not recognized, but were pretty certainly *not* of Eskimo origin. Several apparently were roots reduplicated in a manner characteristic of the jargon, but, to the best of my belief, not so formed in the language as properly spoken among themselves.

Tsau-yū′ may be adopted; at least there is no doubt that such as live near Plover bay so call themselves.

Tsau-yu′.

Reindeer Chukchis of authors.
Chūkchis (variously spelled) of authors, in part.
Reindeer men of the adjacent coast dwellers in conversation with the traders and whalers who know them best by this name.
Tsau-chū of Erman, in part.
Tschekto of Matiushkin, in Wrangell, Sabine's edition, p. 120 (meaning "people").
Tsu-tsin of Stimpson, quoted in Alaska and its Resources.
Tchukchus of Bush, l. c.
Tsau′-yū-at, Dall in R. Geogr. Soc. Proc., l. c.
Kugh-ŭkh-tŭz-ū-mūt of the Diomede Islanders.
Wandering Chukchis of authors.
Koy-ee′-khit of the Asiatic Eskimo (Cape Chaplin).

Lieut. Nordqvist tells us that the termination *at* or *ate* is merely a plural inflection, and that the first part of the word has the collective signification, and in this I have no doubt he is correct, though until his criticism was made I had not looked thoroughly into the matter.

There is, I presume, little doubt that these people adopt slight distinctive changes in their national name according to their native habitat, or that they are in some way divided into clans or tribes, since competent explorers give slightly different names as the tribal name, yet all with a fundamental similarity. Thus Matiushkin on the Kolyma found *Chek-to;* Erman from some source derived *Tsau-chū;* Stimpson, on Seniavine strait, near Konyam bay, obtained *Tsū-tsin;* the writer, near Plover bay, *Tsau-yū;* Nordqvist for the "sedentary" branch on the north coast, *Chau-chau*, and Shishmareff for the same at Mechigme and St. Lawrence bays, *Chau-chū*, for the term "people," meaning themselves collectively. I am inclined to doubt if the *Ch* should not be more properly *Ts*, as in many American tribes, for instance, *Chinook* and *Chehalis*, which we know should be written and pronounced *Tsinūk* and *Tsihalis*, but which have become permanently crystallized in the language under the former erroneous spelling. Nevertheless, as no one is better qualified to pronounce on this subject than Lieut. Nordqvist, his spelling will be here adopted for the people of the Korak race allied closely to the *Tsau-yū*, but who live as the Eskimo do, along the shores, and possess no reindeer, but derive their subsistence from the sea.

CHAU-CHAU.

Chau-chau, Nordqvist l. c. (north coast).
Chau-chū, Shishmareff l. c. (St. Lawrence and Mechigme bays).
Sedentary or *Fishing Chukchis* of authors, in part only.
Namollos, Pritchard and other authors, in part.
Ciukci of Lieut. Bovè.

These people, according to Nordqvist, live along the Arctic coast from Cape Shelagskoi to East cape, and are of the only race represented by living inhabitants on that stretch of coast. So far as the accounts yet published extend, their mode of life, manners, customs (except some of those relating to religious matters), dwellings and implements, differ in no distinguishable manner from those of the Eskimo of Plover bay or the Asiatic shore of Behring sea. The full account which Lieut. Nordqvist will doubtless publish in time, may afford some discriminating features.

In regard to the people at and south-west from East cape, Lieut. Nordqvist seems to be in some doubt as to their exact status, while maintaining, so far as we learn from Stein, a certain reserve on this point, he nevertheless is represented as asserting that they are not Eskimo and that these Eskimo do not occur north of Cape Chukotsky, but reside chiefly about the Gulf of Anadyr. On the other hand he seems to hold that these people on the west coast of Behring strait are composed of a hybrid mixture of Chau-chau and Eskimo blood which is not recognized as their own race by the former, at least not by such as dwell on the Arctic coast.

The synonymy of the Eskimo tribe or race found on the Asiatic shore is the most complicated of all:

YŪ-IT.

Yūit (people), their own name for themselves, a corruption or shortening of *In-yū-it* or *Innūit*, the universal name of the Eskimo stock except of the Aleuts.
Namollo of Pritchard and other older writers.
Tchouktchi Asiatiques, Balbi, Atlas Ethn.
Tuski, Hooper, Markham and Dall, l. c. provisionally. Perhaps a misapplication and corruption of *Tsū-tsin* which belongs to the *Tsau-yū* race.
Chūk'chi (variously spelled) of various authors, erroneously.
Chūklūk'mūt, Stimpson MSS., Dall, l. c. This is a local name of the tribe or local population of Chūklūk island (Ittygrane or Tchirklook of Rodgers' chart), Seniavine strait, and has been so used by me; cf. Contr. Ethn., I, p. 14, 1876.
Sedentary or *Fishing Chukchis* of authors (in part only).
? Onkilon, Wrangell Journey to the Polar sea. This is, according to Neumann and Maidel, a corruption of

Ang-kali or *sitzende Tschukschen*, or

Ang-kadli, meaning dwellers by the sea, cf. Neumann, l. c., or Stein's article.

Aiguan, Nordqvist, according to Stein, l. c.

Aigwan, Maidel, l. c., pp. 67–68; all of the five preceding being names stated to be applied to the *Yu-it* by the *Chau-chau*, and meaning dwellers by the sea.

Kōkh'-lit-inūin, partly, of the American Innuit, according to Dr. Stimpson.

Ū-ū-ūt of the St. Lawrence bay *Chau-chū*, according to Shishmareff (? corruption of Innuit).

Em-nūn-ka, *Kăliā-ing-wir*, *Rliā-rlia-ūt* and *Un-wee-ven* (= *Innūin?*) of the Mechigme bay *Chau-chū* according to Shismareff. The third of these names has a local Eskimo termination and the fourth is probably a corruption of the plural form of *Innūit*.

"*Matsinka*" *men* of the trading jargon, meaning "good" men.

Those living at East cape *(Nūwŭkh)* are called by the Diomede Islanders *No-gwah-mūt'*. Those living at the Chūklūk village in Seniavine strait call themselves *Chūk-lūk-mūt*.

We have then four groups of people to consider and refer to their true relations, namely, the *Tsau-yū*, the *Chau-chau*, the *Yū-it* and the dwellers between Cape Chukotsky and East cape.

With regard to the *Tsau-yū'* and *Chau-chau* we may accept Lieut. Nordqvist's decision that they are mere branches of one people, the differences between which, it is to be hoped, he will eventually make clear. Both are, without doubt, branches of the Korak (or Kariak) stock, and correspond essentially to the divisions of settled and wandering Koraks described by Wrangell, Erman, Bush and Kennan, the last two of whom—having had more intercourse with both the Koraks and "Tchukchi" than any other explorers for many years—unite in the opinion that there is no essential difference of any kind between the two people, either in life or speech.

As to the region occupied by them, it extends from the Kolyma to Behring strait. Even the *Chau-chau*, or sedentary branch, as attested by Nordqvist, resemble the Innuit in their more or less constant movement, to and fro, between different points, as well as in almost every other respect except language and race.

Only the *Tsau-yū*, by reason of their self-transporting sustenance, the reindeer, are able to make long interior journeys.

The relations of the *Yu-it* to the *Innuit* are not doubtful. No one questions their identity in race and language, though their manners have changed in many respects since they migrated from America to Asia.

Their hunting grounds are confined to the coast like those of the

Chau-chau, and about the south-west limit of them, at least, there is little or no doubt. They are slowly migrating southward along the Kamchatkan coast. In 1865, and for many years previously, their visits to the Anadyr river mouth were few and far between, probably not more than once a year on the average, and they had no village there up to 1866. In 1879 a colony had reached Cape Oliutorsk (according to Capt. Owen of the steam whaler *Mary and Helen)*, and planted themselves and sent word for more to follow them as they "had found a good place." These migrants came from Plover bay, where seal were no longer plenty, and had paddled some five hundred miles.

The northern limit is more uncertain, Lieut. Nordqvist puts it at Cape Chukotsky, which is too far south. On the authority of Capts. Redfield and Smith, traders of many years' experience and who understand perfectly the difference between the races, their languages and the trading jargon in use by both, I placed it at Cape Serdze.

The *Chau-chū* of Mechigme and St. Lawrence bays informed Shishmareff, in 1821, that an Eskimo tribe were living on the Arctic coast who wore labrets. One old man at St. Lawrence bay told how he had traveled to the River Amiluk not far from Cape Chavaka (Shelagskoi), from a point beyond Koliuchin island, without seeing any people. At the cape and on this river were people whom he called *Chāvāki*, who wore labrets like the Americans. At Mechigme bay the same people were alluded to as existing on the Arctic coast, and were called *Eg-liū-nok*. Shishmareff saw at both St. Lawrence and Mechigme bays, people of the *Yūit* race; whom the *Chau-chū* said, lived by themselves along the sea coast, obtaining their living from the sea, kept to themselves, spoke a different language and knew nothing about reïndeer keeping. Stimpson, in 1856, obtained a nearly pure Innuit vocabulary at Chūklūk village in Seniavine strait. In nearly every year from 1870 to 1880, Capt. Owen and other whaling masters have obtained Innuit whale fishers from St. Lawrence bay, who stayed by the vessel until she left the Arctic, when they were landed at their homes rich with accumulated stores of salted whale meat and "black skin" to keep them during the winter. In 1880 Innuit came off to my vessel from Cape Chaplin where they have a large village. Their language was almost identical with the Mahlemūt of Norton sound. One of them spoke English well. He said, in response to questions, that they had little intercourse with the *Chau-chū* except in trade, that their languages were entirely different, but that they communicated by the trading jargon: that the "deer men" were rich and the "matsinka men" *(Yū-it)* were poor. They did not intermarry as a rule; sometimes an Innuit girl would marry a "deer man" chiefly because she would always have plenty to eat and little or nothing to do; but the *Chau-chū* women never married *Yūit*, "they would have to work too hard and submit to seasons of semi-starvation." On the other hand, Cornelius, a native of Plover bay belonging to the Eskimo stock, speaking English with great fluency and correctness, informed me that his people had only a commercial intercourse with the *Tsau-yū*, that the shamans of the former had different practices from their own, and that they never intermarried. I asked him what the "deer men" called themselves. He said *Tsau-yū'-at.* But, said I, at Cape Chaplin they said *Koy-ee'-khit.* "I have heard many names given to the 'deer men,'" he said, "but the only name I have ever heard them call themselves is *Tsau-yū'-at.* The name you say is for making fun of them, it is not their own name." I tried to find out what the meaning was, but he evidently was unwilling to explain, and it is evidently some contemptuous appellation, such as the American *Innūit* give the Indians *(In'-ka-lik)* which means "children of louse eggs." This Cornelius had lived a number of years in the United States, had been in Washington as well as New Bedford. The native of Cape Chaplin who boarded me in the strait had also spent a winter in San Francisco, and was very outspoken in his disgust at the white men who were willing to eat turtle, which he had seen at the restaurants, and which he described as "American devil." Their travels are made as members of the crews of whaleships, where they do efficient duty, but I have yet to hear of a *Chau-chau* who has left his native shores.

I have shown that *Yūit* (Eskimo) extend to St. Lawrence bay. For their extension to East cape, beside the authority of several whalers and traders of great experience, I had a pure Eskimo vocabulary, obtained for me at the Nūwūkh village on East cape, by Capt. Smith, about 1872, which is now in the collection of the National Bureau of Ethnology. This, I think, settles the fact of the existence of *Innuit* at that point as late as 1872, and I see no reason for doubting that they still exist there. That occasional parties at the time of the walrus hunt (June) proceed along the coast as far as Cape Serdze, I believe, though the only information I have is derived from several whalers, notably Capt. Owen, who was boarded by them in the autumn of 1879, at nearly the time that the *Vega* was frozen in, and not over fifty miles from that vessel, which was reported to Capt. Owen in such a way that he suspected it to be the *Vega*, and sent a letter by the first party (whom he paid with a large quantity of hard bread, etc.) offering assistance if needed. This letter, however, some time afterward was brought on board his own vessel by a second party of *Innūit*, who demanded large pay for its safe delivery.

The possibility, or probability, of parties of *Innūit* making their way along the Arctic coast at certain seasons does not affect the fact asserted by Lieut. Nordqvist, that the generality of the inhabitants, and perhaps the only permanent inhabitants of that coast, are *Chau-chau*. We know that there are large numbers of the latter at St. Lawrence bay, and doubtless there are also at other harbors on the west shore of Behring strait, including that at East cape, living on perfectly amiable terms with the *Yū-it*.

At Plover bay they do not inhabit the same spot, though near neighbors. I saw an old *Tsau-yū* shaman in 1866, who had come all the way from Anadyr bay to perform certain rites of sacrifice on some of the ovals of upright stones on the hill near the anchorage. He was accompanied by several of his compatriots, while the *Yū-it* clustered round, interested spectators of a rite they did not join in.

Several *Chau-chau* were residents of Cape Chaplin, though most of the natives there were *Yū-it*. Old "Enoch" was one who received each year until his death, a number of casks of strong liquor from the traders, for which he faithfully accounted the following spring.

A word may be said as to the jargon of which I have spoken. It is similar in some of its constituents to a jargon used on the shores of Norton sound and at Kotzebue sound. That is the corrupted Russian, Hawaiian and English words are much the same, but on the Asiatic side there is a large admixture of words of Korak (Chukchi) extraction. *Kau-kau*, corrupted Hawaiian for food, "grub," eatables generally, is in common use on both coasts. *Shawak* or *Chopak*, corrupted Russian for dog (sabak) is in use on both coasts. Many of the words consists of a reduplicated Korak or Innuit root which is used with little or no inflection, while in the original tongues reduplication is extremely rare and the roots are always inflected. Many of these words have an abstract meaning which does not exist in the native dialects, as for instance "*kau-kau*," food. In the dialect of *Chau-chau* and *Innūit* alike, there is no abstract word for food known, but there are special names for each kind of food, which are always used in speaking among the speaker's own people. This jargon was in use, I have reason to believe, in some shape between the *Innūit* and *Tsau-yū*, long before the advent of the whites, but when traders came it was soon amplified by new words for things previously unknown, almost always modified from their original pronunciation by the unaccustomed native tongues (as 'Myr-kan for American; chopak for sabak; tāwā'ka for tobacco, etc).

The confusion can only be cleared up by trained linguists. Ordinary explorers cannot be expected to be qualified for the task. The vocabularies obtained by them will almost certainly be infected by jargon, if indeed not wholly composed of it. Even with the great care doubtless exercised by Lieut. Nordqvist and his companions, I should feel little hesitation in predicting that their vocabularies will be found to contain a certain admixture of Eskimo words, which could be picked out by an expert.

Now if this be the case (and we shall doubtless learn in good time about it), since the mode of life, the general features of physique and the jargon used by both races differ but very little, according to the reports from the *Vega* and the experience of others, how can we say dogmatically that the Innuit are not at any time to be found on the Arctic Siberian coast, until the several villages and their inhabitants have been examined in greater detail than has yet been possible?

I will conclude by noting that the *Innūit* of the American and Asiatic shores of Behring strait are not on good terms with each other. They are not actually at war, as in the time of their discovery by Popoff and Deshneff, but they cherish a mutual contempt. The "*Mātsin'kā* men" of Asia despise the "*Nakū'ruk* men" of America. The inhabitants of the Diomedes, who do most of the intertrading, warned us, in 1880, against the "bad men" of East cape. The Plover bay natives (*Yūit*) were outspoken in their contempt for the American *Innūit*.

The long journeys from Asia to America formerly performed by the natives, are now unnecessary on account of the visits of traders to both shores, and are seldom or never undertaken. The Diomede people, however, visit both shores and carry liquor from Asia to America. The increasing scarcity of food is impelling a southward migration as previously mentioned, and it may not be many years before the native Eskimo population of Asia may be located where Lieut. Nordqvist at present has somewhat prematurely placed them, namely, to the south and west of Cape Chukotsky.

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THE LENGTH OF LIFE OF BUTTERFLIES.[1]

BY W. H. EDWARDS.

SOME inquiries on the subject led me to investigate the matter, and to refer to my note books, in which are recorded everything that has come under my observation relating to butterflies for the past fifteen years.

Boisduval, and Kirby, and Spence allege that the life of the summer butterflies is brief, the male expiring soon after copulation, the female after oviposition. On the other hand, Mr. Scudder has spoken of butterflies living two to three months. Mr. Edwards expressed the opinion as to the hibernating butterflies, that they lived from about the 1st of September to the end of the following May, or eight to nine months at the outside. Whereas Mr. Scudder asserts that *D. archippus* lives from a year to fifteen or sixteen months.

Observations show that one brood follows another in rapid succession in many species at the South, a month sufficing for the complete duration of the generation. As the emergence of individuals from the chrysalis is not all at once, but is continued through several days or weeks, it follows that the life of any individual butterfly must be much less than the duration of its generation; certainly not over one-half to two-thirds that of the generation. In the case of polymorphic species like *Papilio ajax*, it is not difficult to fix the duration with some definiteness. Mr. Edwards gave from his note books dates of the first and last appearance at Coalburgh, W. Va., of the form *Ajax walshii* and of the form

[1] Abstract of a paper read at the Cincinnati Meeting of the American Association for Advancement of Science.

Ajax telamonides, and showed that an individual life could hardly be more than two to three weeks. It was stated that not only in this species but in most or all which had come under observation, it is the old males which mate with the young female as soon, or nearly as soon, as she emerges from the chrysalis. These old males are on the watch, flying about everywhere, and seize the young female, often before her wings are dry, and hence before the young male, if emerging at the same time with the female, would be strong enough to take part in the copulation. Consequently it happens that many of the males are unable to find mates, and these males are the longest lived. The last butterflies of the generation are often seen to be old males, who probably have never mated.

Similar conclusions as to the duration of life were drawn from observations on the polymorphic species, *Lycæna pseudargiolus* of which *L. violacea* is the early form.

For an example of the hibernating species, the history of *D. archippus* was detailed. It is three or four brooded in West Virginia ; the old females die in May after laying their eggs. These eggs produce the first generation of butterflies of the year, and the females of this lay eggs which produce the second generation, and so on to the end. The eggs are always laid by females plainly not long from the chrysalis. We have carefully watched this species all through the year 1878, and had given the results as briefly stated here in *Psyche*, Dec., 1878. This was because Mr. Scudder, in *Psyche*, July, 1875, had represented Archippus as having habits unlike any other butterfly, in that it was single-brooded over North America, and not double brooded; that it left its winter quarters late and continued on the wing the rest of the season, laying eggs all the time, so that the caterpillars to be found all along through the season were produced by its eggs, *instead of coming from the eggs of young females.* The young females in fact could not lay until they had passed hibernation. It will be seen that such behavior involves a radical change of habits of the race, wherein this butterfly, laying eggs at intervals for months, approaches the mammals.

Mr. Scudder recently repeats this story in his "Butterflies," 1881, without note or comment or any additional data, or any verification at all, and hence Mr. Edward's paper.

NOTES ON THE MIGRATIONS OF BIRDS.

BY H. D. MINOT.

LITCHFIELD is in the highland of Western Connecticut, from nine hundred to twelve hundred feet above the sea, somewhat sparsely wooded, though well watered by southerly streams, running either into the Naugatuck valley or into the system of Bantam lake (the largest body of fresh water in Connecticut, with an area of about twelve hundred acres). My observations there extended from October, 1880, to May, 1881, inclusive of both months, and suggested to me, concerning:[1]

(1) Pioneer migrants: that the single temporary forerunners of a species, so often observed among early non-gregarious migrants before the arrival of their fellows in numbers, may serve more than a purely individual purpose. A single record will illustrate: April 1st I observed by a particular bridge the first pewee, dejected, silent or petulant, and hurried, soon flying out of sight *southward;* for a week no pewees were to be seen or heard there or anywhere about; April 8th was pewee-day, bringing these birds in numbers, and at the bridge appeared a triumphant pewee with his mate.

(2) Local differences of time.—Migrant cat-birds appeared in outlying swamps a week or more before the resident cat-birds returned to their village home; and king-birds appeared down

[1] Before remarking on migrations here, I append the following dates of arrival: March 12, blue birds (in numbers); 15, song sparrow, *snow bird,* fox sparrow, red-winged blackbird and rusty grakle; 25, meadow lark; April 1, the first pewee; 3, horned larks; 9, downy woodpecker; 20, white-breasted swallow, Savannah sparrow, bay-winged sparrow, cow bird and kingfisher; 22, hermit thrush; 23, red-poll warbler, martins, swamp, field and chipping sparrows, yellow-bellied woodpecker (among hemlocks) and golden-crowned kinglet (absent latterly in winter); 24, ruby-crowned kinglet (singing), yellow-rumped warbler, barn swallow, solitary vireo, and purple finch, and goldfinch (after a long absence); 28, brown thrush, creeping warbler (*Mniotilta*), white-throated sparrow (earlier?) and towhee; May 1, orchard flycatcher (*Empidonax minimus*—the first appeared April 27); 3, Swainson's thrush (a pair in a pasture (!) by a rill), cat-bird, oven-bird, yellow warbler, and king-bird; 5, house wren; 6; Wilson's thrush and redstart; 7, warbling vireo; 8, chestnut-sided warbler, Maryland yellow-throat, Baltimore oriole (abundant next morning), "night hawk" (in the village) and wood thrush (probably); 9, Nashville warbler, "blue yellow-back," etc., red-eyed vireo, rose-breasted grosbeak, bobolink and Traill's flycatcher; 10, wood pewee and whippoorwill; 12, cedar-birds; 13, yellow-throated vireo and black-and-yellow warbler (or earlier); 14, scarlet tanager; 15, black-billed cuckoo, and so on. Blue birds had eggs in the last week of April; robins and pewees began to lay about May 1st.

by the lake, three miles off, several days before advancing to the outskirts of the much higher village. *The most favorable haunts are the first revisited.* Local differences of season, too, are very considerable: April 30, a visit to Bethlehem, nine miles southward, showed a week's advance.

(3) The great influence of season and the comparatively little influence of temporary weather (except on water fowl).—Crows moving southward in large bodies in the latter part of October, predicted to me a severe winter. It proved one of extraordinary and almost uninterrupted severity, without any midwinter thaw. In the first week of March these crows returned (three hundred debating one afternoon whether to roost in Litchfield woods or to pass on), our first spring weather forthwith followed, and real winter did not reappear. Snow-birds *(Junco hyemalis)* were absent all winter, following southward the unusually extended and steady line of frost and snow; and nuthatches and most of their kindred were absent during the latter or stormy part, marked especially by ice-storms. On the other hand, some warblers, after a month of bright, lovely weather, waited to appear in the face of the cold, blustering, lasting northeaster that set in May 16. In spring, moonlight is taken advantage of by birds like water-fowl, that make long voyages in long flights; but it affects little our insessorial birds, who, however much they may profit by the harvest moon in autumn, in spring are more strongly impelled to migrate, and reappear pretty regularly, independently of the lunar calendar. For instance, at home I have noted the arrival of a particular pair of Wilson's thrushes year after year, between the 5th and the 10th of May, often coming apparently in the night, however young or old the moon might be. No doubt, however, as I have even detected sometimes, migrants that seem to have come in the night, often arrive in the evening, simply traveling till a late hour of the day before resting, and the next morning may linger for refreshment before resuming their journey. In building, on the contrary, activity is in the morning.

(4) The uncertain order of species.—In spite of pretty regular habits of migration among the later comers, accidental circumstances produce such variations that there is no certain order or procedure among the different kinds, even near relations. Whether the chipping or the field sparrow (Spizellas) will appear first in a given locality where both are common, who can safely predict?

(5) The routes of New England migrants.—In visiting Lenox, Berkshire county, Massachusetts, several years in April, I have been astonished to find that though so high (1200–1300 feet above the sea), and in spring so bleak and backward, it gets some of its birds (for instance, bay-winged and chipping sparrows) before either Boston on the coast or Litchfield, lower and over forty miles more south—as I have determined by returning to these places from Lenox, and making immediate comparison. 1881—Bay-winged sparrows in full song at Lenox, April 16; I returned to Litchfield two days later, but found none till the 20th. The configuration of the country, in connection with such observations, seems to show that many birds follow the coast and rivers, ascend broad valleys sooner than narrow, and thence spread up the slopes and hills, perhaps escaping occasionally through gaps where water-courses nearly meet, from one basin to another. Therefore migrants, especially those hurrying, are comparatively few, or wanting, along high ridges—as exemplified at Litchfield by the scarcity in spring of warblers of the Canadian fauna.

(6) The effects of elevation on the ornithological calendar.—Though comparisons of full value should be based upon simultaneous and repeated observations, I venture the conclusions (illustrated by my list of dates, based upon daily search) that Litchfield, as compared with Boston, is, from its elevation, backward in its spring, and in getting the earlier migrants, but that when, after a few hot days, it suddenly gets its summer with wonderful rapidity, it gains from being nearer the south-west sources of migration, and gets its later resident birds—for instance, the wood pewee—sooner.

(7) Local variations.—Such are the autumn congregation of over a dozen golden-winged woodpeckers in a flock, and the singing of field sparrows and of redstarts here often with a falling instead of a rising inflection. Such specific variations as red-winged blackbirds, in their spring chorus, congregating commonly in one tree, while the rusty grakels often each take a tree top or limb for himself, and such individual variations as a nuthatch cracking open a hard nut (probably for a maggot) are also curious.

I subjoin here, though the evidence is not complete, the records of a Tennessee warbler, May 6, 1881, and of a black-and-yellow warbler nesting. Martins, a gentleman here tells me, kill interlopers of their own species, cracking the skull.

SOTOL.

BY DR. V. HAVARD, U. S. ARMY.

Name.—This interesting member of the Liliaceæ has been described under different names; it is the *Dasylirion texanum* Theele, of Watson's "Revision of the Liliaceæ," and the *Dasylirion graminifolium* Zucc., of Torrey's Botany of the Mexican Boundary Survey. It appears to me that the *D. wheeleri* Watson, may not be specifically distinct from it.

Sotol is the Mexican name under which it is well known along the Upper Rio Grande, and bear-grass its common, meaningless Texan appellation.

Description.—Perennial, characterized by a thick tuft or cluster of long, green, armed leaves, from the midst of which rises, periodically, a stout stem ten or twelve feet high, bearing a long, close panicle; caudex none or rarely, in old plants, six to eighteen inches high; leaves very numerous, roughly estimated at four or five hundred, erect in the center, thence gradually spreading to the ground, their expanded, white, ladle-shaped bases four or five inches long, three or four inches wide and two lines thick, ending rather abruptly into the long, narrow body of the leaf with which it contrasts sharply in color; at the point of transition is a pair of thin, coriaceous wings; leaf, exclusive of the base, three to four and a half feet long, seven to ten lines wide below, gradually tapering to a point which is split into coarse fibers; armed on both sides with teeth hooked downwards, very variable in shape, size and relative distance mostly two lines long and six lines apart, often tinged with violet at apex or throughout; edges between the teeth finely serrated; panicle two or three feet long; partial panicles three to four inches long, erect in the female plant, flexuous and pendant in the male, subtended and often overtopped by broad, lanceolate bracts; fertile racemes two to four, staminate racemes only one to two inches long; fruit three-winged, broadly oval or subcordate, three lines long, on pedicels hardly one line long; the narrow wings less than one line wide, sometimes free, generally more or less adnate to the style, straight or diverging but seldom rising above it; seed triangular pyramidal with obtuse apex, 1 line long and broad, minutely rugulose under a lens; embryo slender, cylindrical, in the center of a horny albumen as long as the seed.

It may be seen that this description differs from that of authors in some particulars, such as the absence of any conspicuous caudex, the larger size of the leaves and hooks, and the variable degree of adnation of the wings to the style in the fruit.

The bear-grass produces a fructiferous stem every three or four years, when sufficient material has been accumulated in the succulent leaves. It is mainly propagated by seeds shaken off their stately support by the wind and carried away in various directions; the young plant grows rapidly and shoots its first stem when four or five years old. It blossoms late in summer and the seeds ripen in the fall; most of them remain on the stalk all winter, and many persist until late in the ensuing year.

Habitat.—The home of the sotol is Western Texas, Southeastern New Mexico and Northern Chihuahua. Proceeding westward from San Antonio, I first met it after crossing the San Pedro or Devil's river; beyond the Rio Pecos it becomes abundant, covering almost exclusively square miles of arid and stony slopes, beyond question the most striking botanical feature of the country. It extends west, probably to the Colorado. If specifically it includes the *D. wheeleri* Watson, it is the prevalent Dasylirion of Southern Arizona.

The sotol grows best at a certain altitude, five or six hundred feet above the level of the Rio Grande, that is to say, above the region of the *Yucca baccata* and the lower line of the *Agave lechuguilla*, on nearly all the foot-hills of Western Texas. It thrives in dry, rocky soil where no grass can grow, and sometimes, insinuating its long, filamentous roots into invisible fissures, seems to spring from the living rock.

Uses.—The first experience of the traveler with the bear-grass, whose hooks scratch and tear everything they touch, is a disagreeable one; but further acquaintance with frontier life makes him consider it one of the beneficent provisions of nature. In some of our camps, where other fuel could not be procured, we made good fires of the old stems of this plant. These are sufficiently strong and long for use in building the walls and roofs of huts or Mexican jacals. As a fiber plant the sotol is worthless; even if it were possible, with the defiant hooks, to scrape off the fibers, they are too few and weak to be serviceable.

The base of the leaves and the young stems are full of a sweet, refreshing and nourishing saccharine matter which supplies food and drink; no one need suffer from thirst or hunger who finds a tuft of bear-grass and has a long handled knife or an axe with which to overcome it and cut off, as low as possible, some of the central leaves; often these can be torn off by pulling them with a twist at the unarmed apex. The nutritive saccharine substance lies mostly in the white, expanded bases which always give to the test a large proportion of glucose. These bases are closely and compactly imbricated into a bulby expansion or "head," from which the leaves proper seem to grow; this head, trimmed down to the white, fleshy moss, is ready for use either on the road, in the Mexican kitchen or by the mescal manufacturer. For eating, it can be boiled, broiled or baked, previously, if convenient, cutting an axial hole through it to render the cooking more rapid and thorough. Broiling on coals takes an hour or less. Baking, the usual mode of preparing it for food, is done in an oven or, if in the field, in a small heated pit where it is kept about twenty-four hours, or until it has acquired a rich brown color. The scales are detached and eaten as needed after pealing off the thin epidermis covering both sides, or again they may be ground into atole. Their sweet taste, not unlike that of molasses, reminds one of the "mescal" of the Arizona Apaches, that is, the baked head of the *Agave palmeri* and *Agave parryi*. This, however, differs from the sotol head in being much smaller and consisting mostly of the thickened top of the rootstock, so that its solid, homogeneous mass can be cut in slices like a cake.

Sotol mescal.—The main and paramount use of sotol is in the making of a spirituous liquor known as "mescal" along the border, but in the interior of Mexico, to avoid mistaking it for a similar product from maguey, called sotol mescal. This fabrication is carried on mostly in the Mexican States of Chihuahua, Cohuihuila and Sonora, and sotol mescal is the ordinary alcoholic beverage of the native population. It is precluded in Texas by the high duties laid on this class of industry.

The distillery, or vinata, is located in foot-hills, near water, and in the midst of a perennial crop of bear-grass. Trains of burros bring in every evening their loads of heads; these as trimmed by the axe of the peon and ready for the oven, are subconical in shape, twelve or fifteen inches high and broad, and weigh from twenty to twenty-five pounds; they attain much larger dimensions in favorable localities, and a vinata proprietor has even assured me that it is not uncommon to find them measuring two feet or more in diameter and weighing as much as seventy-five pounds. All heads seem to be good for the purpose, even those with a growing stem are not spared, though they doubtless contain less sugar, and the cutting is only suspended by the floods of the rainy season, from June to September, during which period the vinata is closed, and the mescal bibber constrained to reform; now also is the time to shift the establishment, if needs be, to a more abundant field of sotol.

The oven in which the heads are baked is a circular pit about ten feet in diameter and depth, and lined with rough stones. Into it combustibles are thrown and a brisk fire kept up for one day; it is then cleaned, filled with heads and lastly covered with a roof of hay and earth well trodden down. In three days the baking is through; the heads are now chopped with hatchets and the fragments pounded into a coarse, shreddy pulp, which is thrown into vats four or five feet square, to undergo fermentation; in cold weather warm water is added, otherwise it does not appear to be necessary. During the first few days bare-legged men tread in the vats to stir and mix the pulp. In from six to ten days, according to season, the fermentation ceases and the contents of the vats, solid and liquid, are transferred to the still. The first liquor obtained, being richer in alcohol and possessing to a higher degree the peculiar aroma of sotol mescal, is considered of better quality. The used-up leaves, still sweet to the taste, are fed upon with relish by the donkeys, hogs, dogs and chickens of the vinata.

A rough calculation makes me estimate at one pint the quantity of liquor obtained from one average head; the yield would doubtless be much greater if, instead of roughly pounding the baked heads, they were crushed into a fine pulp by appropriate machinery. A vinata in good running order will turn out a Mexican barrel a day (about twenty-eight gallons), sold at an average price of fifteen dollars, and retailing for thirty or forty cents a quart. The revenue laws of Mexico, exceedingly severe on articles of prime necessity, are very lenient on the vinatas, which, if first-class, are only taxed fifty dollars a year.

The liquor obtained from the sotol is limpid and colorless, its smell penetrating and its taste, *sui generis*, somewhat raw, pungent and bitter, but with a pleasant aroma not unlike the smoky flavor of Scotch whisky. Its percentage of alcohol is about that of whisky, perhaps a little higher; it burns readily with a yellowish, purple flame, leaving an intensely bitter residue, and gives an acid reaction with litmus paper.

Sotol mescal is a pure, wholesome alcoholic drink; if the best brand be kept long enough to lose its sharp edge, it compares favorably with good whisky; Mexicans prefer it, and with reason, to the ordinary frontier whisky, and the American toper takes kindly to it if the latter be not readily accessible. On account of its cheapness and characteristic taste, mescal is very seldom adulterated. As far as I have observed, it has no peculiar effect upon the system; stomach, liver and kidney troubles, which might be referred to its action, are very rare, nor do the acid, pungent and bitter elements, contained in it, seem to affect any of the organs unfavorably. In the parlance of the toper, and to his thinking no mean advantage, there is much less headache in it than in whisky.

This sotol mescal should not be confounded with maguey mescal, or tayuile, the product of the maguey plant, *Agave americana*, and the liquor perhaps more generally known under the name of mescal in the United States; it is extensively manufactured in the interior Mexican States from the abundant sap collected in the cavity made by removing the young central leaves. Although much like it in taste and effects, it is a finer article than the former and commands a higher price.

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THE FAUNA OF THE NICKAJACK CAVE.

BY E. D. COPE AND A. S. PACKARD, JR.

THIS cave is situated near that point of the southern boundary of Tennesse where it is joined by the line which separates the States of Georgia and Alabama. In dimensions it ranges with the Mammoth and Wyandotte caves of Kentucky and Indiana, whose faunæ have already been described in earlier volumes of the NATURALIST. Many miles of galleries have been explored, and no end has yet been reached. The entrance is in the northern side of a hill, not far from the road that passes on the south side of the bottom of the Tennessee river. It is of much more imposing proportions than that of either of the caves already mentioned. The visitor climbs the hill from the road, following a path which leads along the high bank of a considerable creek. The entrance has a wide floor which is cut by a gorge at one side, through which the stream just mentioned, issues. The roof is flat and is overhung by vegetation. The following pages record the results of two collecting expeditions made there by Professor Cope.

Near the mouth of the cave a salamander of the genus *Plethodon* was found, which is very peculiar. Instead of the black color with or without pale bluish dots, of the *P. glutinosus*, the sides and back are thickly spotted with large irregular yellowish-green blotches of irregular form, producing an effect something like the coloration of the Mexican *Spelerpes leprosus.* The dorsal spots are much larger than the lateral, and are often confluent. On the head they almost exclude the ground color. In addition to this color peculiarity, the feet differ from those of the *P. glutinosus*, in the rudimental character of the inner digit, both anteriorly and posteriorly. It is represented by metapodial bones only, having no phalanges. There are thirteen costal folds, one less than in *P. glutinosus*, and the vomerine teeth do not extend beyond, or even to, the internal nares. The tail is round and rather slender. Length to axilla, .020 ; to groin, .051 ; to end of tail, m. .122. This species is about the size of the *P. glutinosus*, and as it is distinct from it, we propose that it be called *Plethodon æneus* Cope.

In company with it was found the smaller *P. cinereus.* Then there was a small scorpion ; a *Polydesmus*, and some other centipedes, and a beetle like *Scarites*, but larger than the common northern species. Snails, as in other limestone regions, are abundant.

On entering the mouth of the cave abundant traces of former human habitation are found. These consist principally of charcoal and remains of shells—as Ios and Unios from the Tennessee river, brought there by the Indians as food. The creek was formerly dammed at this point and supplied water to a mill at the mouth of the cave. This was grinding the grain of the neighborhood at the time of the first visit, but had disappeared by the second. Fishing was attempted from this point far into the depths of the cave. The results were chiefly Crustacea, which are described below. No blind fishes were seen or taken, but some fishes of the outer world were caught at a point where a very little light from the mouth was distinguishable. These were the common blob, *Potamocottus meridionalis*, and sucker, *Catostomus teres*.

At a distance of a mile from the mouth, the blind crawfish, *Orconectes hamulatus*, began to be abundant; their snowy white forms being readily distinguished by candle light in the clear water.

On the land the *Spirostrephon cavernarum* proved to be common in some places, especially near to bat excrement, where were also found a number of Pselaphid beetles.

On examination of the aquatic cave life, it appears that of the five kinds of animals found living in the waters of the cave, all but one differ decidedly from those of the caves of Kentucky, Indiana or Virginia. This is a matter of considerable interest from an evolutional point of view, as it shows that these cave forms are the descendants of different out-of-door species from those of the caves to the northward. The Nickajack cave may be in a different faunal region from the Mammoth or Wyandotte caves, and thus the blind crawfish has perhaps originated from a different species of Cambarus than that which gave origin to *Orconectes pellucidus*. Thus while the conditions, such as dryness and temperature, of cave life are much the same throughout the United States, the ancestors of the different cave animals were, in most cases, distinct, since they belonged to somewhat different zoö-geographical areas.

The first animal to notice, and one not uncommon in the waters of the cave, is a little Isopod Crustacean which is evidently a modified Asellus, or water wood-louse, of the same genus as that so abundant in the caves, subterranean streams and wells of Indiana and Kentucky. We originally described the Mammoth cave form as *Cecidotæa stygia* Packard; our new species may be called *Cecidotæa nickajackensis* Packard.[1]

[1] It is eyeless, and the body is longer, narrower and slenderer than in *C. stygia*. The first antennæ are very long and reach to the end of the third joint of the second antennæ; they are nearly twice as long as in *C. stygia*, and are purplish white, while the flagellum is provided with long hairs. The second antennæ are as long as the head and extend backwards as far as the base of the abdomen. The legs are much longer and slenderer than in *C. stygia*. The abdomen is long and narrow, and the caudal appendages are moderately long in one specimen and short in another; in one individual the outer branch is much shorter and smaller than in the others, and in most it is as long as the basal joint. On the whole the caudal appendages are no longer than the telson or terminal segment of the abdomen, while in *C. stygia* they are half as long as the entire body. Length 6 mm.

This species forms, in the antennæ and slightly purplish color and the proportions of the leg-joints, perhaps a nearer approach to the genus Asellus than that of Mammoth and Wyandotte caves; on the other hand *C. stygia* approaches Asellus more in its shorter, broader body, with the shorter, broader abdomen. It seems quite evident that the two species must have descended from different species of Asellus. Thus far we know of but one species of Asellus, *A. communis* of Say, from the Middle and Northern States; whether there is an additional species in the Gulf States from which the present species may have been derived, remains to be seen.

The genus Cecidotæa differs from Asellus in the larger and much longer head, the longer claw of the first pair of feet, the much longer telson, and in the rami of the caudal appendages being of nearly equal size, while in Asellus one is minute; it is also eyeless. The *Asellus borelii* of the Swiss lakes belongs to *Cecidotæa.*

The second crustacean discovered swimming about in the subterranean stream, was a species of Amphipod belonging to the genus Crangonyx, and which may be called *Crangonyx antennatum* Packard.[1] It is a large purplish species with very long antennæ, and distinct, well developed black eyes. This genus occurs in caves and subterranean wells in Europe and this country.

The form of most decided interest, however, is the blind craw-

[1] It is a larger and purplish species; the first antennæ very long; the flagellum with 20–24 joints; the entire antenna being over one-half, and nearly two thirds as long as the body; the last joint of the peduncle being slightly more than half as long as the penultimate joint. Compared with *C. gracilis* Smith, from Lake Superior, it differs in the form of the eyes, the longer and stouter first antennæ, the flagellum having a greater number of joints, and in the different proportions of the joints of the peduncle; the second joint of the latter being much longer than in *C. gracilis,* while the first joint of the scape is much longer, and the second and third joints one-third longer in proportion than in *C. gracilis.* The fourth pair of epimera are unusually large and nearly square. The telson, together with the caudal stylets is much as in *C. gracilis,* but the rami are slightly stouter and more polished, and the spinules a little stouter. It probably is a little larger species than *C. gracilis,* the specimens being 6–7 mm. in length; the eyes are not so distinct and are only one-fourth as large as in *C. gracilis.* It is very different from *C. vitreus* Cope, of Mammoth cave, and from *C. packardii* Smith, differing in its distinct eyes, and larger, more numerously jointed antennæ.

THE FAUNA OF NICKAJACK CAVE

fish (*Orconectes hamulatus* Cope[1]). It is quite different from *O. pellucidus* of Mammoth and Wyandotte caves, in the rostrum, the slender hands, the much broader antennal scale, and in the form of the gonopods, while the whole creature is slightly slenderer than *O. pellucidus*, though the rudimentary eyes are of the same proportion to the neighboring parts as in the other species.

It is obvious that the form from which *O. hamulatus* has been derived, is quite different from that which has given origin to the blind crawfish of the Kentucky and Indiana caves. The most common species in Northern Georgia is *Cambarus latimanus*, it having been found at Athens and Milledgeville, Georgia, and probably being abundant in the northern limestone region of Alabama. At any rate it is perhaps to *Cambarus latimanus* that

[1] In this species the teeth of the mandibles are usually much sharper than in the other blind species, there being three well marked sharp posterior teeth in *O. hamulatus*, which in *O. pellucidus* are represented by low, obtuse, nearly obsolete teeth; though in different specimens the obtuseness of the teeth vary. The epistoma is much as that of *C. bartonii*, but shorter and broader; while the median terminal tooth is less marked than in *C. latimanus*, and the sides fall away rapidly from the front margin. It is entirely different in shape from that of *O. pellucidus*. The antennal lamina is shorter, broader and much more rounded on the inner edge than in *O. pellucidus*, and in this respect differs from *C. latimanus*. The rostrum is narrower than in *O. pellucidus*, while the first pair of (large) claws are much slenderer, and the telson narrower than in *O. pellucidus*. The most obvious difference is seen in the modified first and second pairs of abdominal feet of the male, to which we may apply the term *gonopod*, for it is not properly an intromittent organ. The first and second pair of gonopods differ decidedly from those of *O. pellucidus*, and closely resemble those of Form II of *Cambarus latimanus* (from Athens, Georgia, figured by Hagen), those of the first pair being shorter, thicker and the last joint being much bent, hook or sickle-shaped, whence the specific name *hamulatus*. The first gonopods differ in the proportion of parts from those of *C. latimanus*, but the joint is much more acute than in *C. latimanus*.

The first pair of gonopods, compared with the *latimanus* form of *obesus* from Maryland, given me by Mr. Uhler, are much like it in general form, but the sinuous branch is longer and straighter, while the hook is much slenderer. In the second pair of accessory gonopods the knob is proportionately smaller. In other more important characters *O. hamulatus* is quite unlike the *latimanus* form of *C. obesus*, the scale of the second antennæ being very different and the chelæ one-half as wide, and the antennæ much longer, while the rostrum is much longer and more pointed. Length of the largest male, 5 centimeters.

Note on the function of the Gonopods.—As stated by Milne Edwards and others, the gonopods of the crawfish are not intromittent, but simply rude gutters for the passage of the fertilizing fluid to the eggs. It is obvious that in the lobster the gonopods form simply a rude tube or gutter to conduct the seminal fluid to the eggs as they pass backward from the oviducts to the swimming feet of the female. During the process of fertilization of the eggs, the male, without doubt, as in the crawfish, holds the female by the claws, she resting on her back. The term *gonopod* is applied for convenience in descriptive carcinology to the external reproductive organs of the crustacea, since they are only modified limbs.—(A. S. PACKARD, JR.)

we are to look for the ancestors of *Orconectes hamulatus.* On the other hand, in the form of the body, of the scale and rostrum, as well as of the upper lip and the chelæ (though not of the gonopods), *Orconectes hamulatus* approaches *Cambarus affinis.* Now of all our North American crawfishes, it would appear, as Mr. Uhler has told the writer, and as seems evident to us upon an examination of several types and the excellent figures of Dr. Hagen, that *C. affinis* is the more generalized form, and this is tantamount to saying that it is the ancestral form of our North American crawfishes. So while our Nickajack blind crawfish may have been an immediate derivative of *C. latimanus* of the Gulf States, it probably ultimately originated from *C. affinis*, a more wide-spread species.

It is also of interest to note that *O. hamulatus* presents the same generic characters as *O. pellucidus*, the eyes being rudimentary, functionless, the body long and the appendages slender; we thus feel justified in separating the genus from Cambarus.

Of the two crickets found in Nickajack cave, there were three small specimens of *Hadenœcus subterraneus* Scudder, which only differed from Mammoth cave individuals in having rather shorter, thicker maxillary palpi; but this is not even a varietal difference, as the antennæ and legs have the same proportions. The other cricket is a new species of Ceuthophilus, and may be called *Ceuthophilus ensifer* Packard.[1] It is very nearly allied to *C. stygius* of Mammoth cave, but may be distinguished by the characters given below.

EXPLANATION OF PLATE VII.

FIG. 1.—*Orconectes hamulatus* Cope, twice nat. size. 1 *a*, antennal scale, enlarged; 1 *b*, first gonopod.

FIG. 2.—*Crangonyx antennatus* Packard. 2 *a*, end of abdomen and appendages; 2 *b*, head with base of upper, and entire lower antenna and eyes; 2 *c*, claws; all enlarged.

FIG. 3.—*Cecidotœa nickajackensis* Packard (only one pair of antennæ drawn). 3 *a*, upper or smaller antennæ; 3 *b*, end of telson with the caudal appendages; all enlarged.

FIG. 4.—*Ceuthophilus ensifer* Packard, nat. size. 4 *a*, end of abdomen, with the outer rhabdite or blade of the ovipositor bent up to show the shape of the toothed ovipositor, the six teeth are not well shown by the artist; 4 *b*, the end of the body with the ovipositor. J. S. Kingsley, del.

[1] This species differs from *C. stygius* Scudder, of Mammoth cave, by the much more pointed sabre-shaped ovipositor, its tip being long, slender and acutely curved, with six smaller teeth, there being but five in large individuals of *C. stygius*, in which the ovipositor is blunt, and the tip obliquely truncate, while the hind femora are a little longer. The eyes are as well developed as in *C. stygius.* The color and marking are much the same in the two species, both being thickly spotted with black-brown; *C. ensifer* has darker colors and more distinct spots than *C. stygius*, though the latter grows to a larger size. Length of whole body, not including the ovipositor, 22 mm.; length of ovipositor, 8 mm.; of hind femur, 20 mm.; of hind tibia, 20 mm. It differs from *C. lateus* Scudder and *C. sloanii* Packard in the longer legs, and can only be confounded with *C. stygius.*

EDITORS' TABLE.

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

—— The International Geological Congress and the Zoölogical Society of France have recently adopted rules for the regulation of nomenclature in the systematic biological sciences. These resemble, in most respects, those previously adopted by the British and American Associations for the Advancement of Science. After reading them, we wish to signify our approval of them, with one slight modification in each.

The gist of the whole matter lies in the interpretation of the law of priority. The above-mentioned rules all agree that priority rests on definition, both for generic and specific names, but the rules of the congress and of the zoölogical society add some conditions which we wish to note. The rules of the former body say (p. 121): "For specific names priority shall not be irrevocably acquired until the species shall have been not only described but figured." Our objections to this doctrine have been fully set forth in an editorial in the July NATURALIST. They are two. The first is, that anything which may be taken as a substitute for a characteristic and analytical description is objectionable. Intelligent and intelligible descriptions are more needed than figures, and they are entitled to especial recognition when they are produced. Second, illustration is not always within the reach of naturalists, especially out of Europe. We do not wish, however, to be understood as detracting from the importance of iconography.

The rules of the zoölogical society say: "The name used for each genus and each species can be no other than that by which it was first designated, on condition: *a.* That it shall have been issued in a publication where it shall have been clearly and sufficiently defined; and *b*, that the author employs the binominal nomenclature." Our criticism is here directed against the language "clearly and sufficiently defined." While insisting on description as a basis of nomenclature, we cannot be very exacting as to the quality of the description. "Sufficiently" described, that is without defect or excess, is a perfection which few specific or generic descriptions can present in that stage of a science in which they first appear. This requirement is impracticable. "Clearly" defined these groups can and should be, although the diagnosis may be imperfect, but who is to decide when the degree of clearness is sufficient to satisfy this rule? This requirement also cannot be carried into practice, however much we may desire the reverse were true. Nothing remains but that we accept any description and diagnosis, and when these fall below the standard set by our French colleagues, let the critic and reviewer use their best endeavors that such defects be made as odious as possible.

In the Proceedings of the U. S. National Museum, Professor Gill insists on the adoption of a generic name proposed by himself without description, in preference to a name proposed later, by another author, whose description contains some errors. The opposite course had been pursued by Professors Jordan and Gilbert, a circumstance which gives rise to the criticism in question. Professor Gill admits the facts to be as above stated, and thereupon makes the following remarks: "What is the advantage of any description? According to the rules of the British and American Associations for the Advancement of Science, a description is necessary as the basis of permanent nomenclature, but like many of the other rules propounded in those codes, there is no proper logical basis therefor." Professor Gill then proceeds to make the usual statements about the inadequacy of the earlier generic descriptions, etc., a mode of reasoning generally resorted to under similar circumstances.

In taking his position, it is evident that Professor Gill and his school (for he is not alone in his views) have to contend not only with the wisdom of the American and British Associations, but with that of the other bodies above mentioned. It would seem superfluous for us to defend a fortification so strongly held, but the heresy in question has had considerable run in America, and it is fitting that said linen should be washed where it has been soiled.

In brief then, one reason why a description is necessary in adding a new name to scientific nomenclature, is, that science is science and not literature, a distinction occasionally lost sight of by a few writers on natural history. In other words, it deals with things, and not words, and the only connection words have with science, is to represent things. As this cannot be done without a preliminary definition, names alone *(nomina nuda)* do not belong to science at all, but to the arts of composition and literature. Second; the inconvenience of the substitution of literary methods for scientific methods in scientific work, is so great, that scientists have felt compelled to protect themselves against these "literary fellows." By insisting on definitions, these gentlemen are placed in a somewhat embarrassing position. They do not wish to forego the pleasure of creating a new lexicon, but to compose a diagnosis is for them a very serious business. Literature, a critic says, deals with "manner," while science treats of "matter," and a diagnosis is a concentrated extract of matter. Between the two horns of the dilemma he will generally (not always we are sorry to say) prefer the less conspicuous course, and abandon nomenclature as a profession.

RECENT LITERATURE.

SCUDDER'S BUTTERFLIES: THEIR STRUCTURE, CHANGES AND LIFE-HISTORIES.[1]—In this book we have a very successful attempt at a thorough study of the butterflies of a limited region, New England, not only from the point of view of the structure of the winged insects, but also of their transformations; and the author does not stop here, where many books on butterflies would naturally end, but in the light of modern biological science, he leads the student to observe their habits, their seasonal changes and histories, their styles of coloration, the sexual differences in coloring and structure, and the probable reasons for such diversity; then he speculates on the origin and development of ornamentation, on the ancestry of butterflies, and presents a genealogical table which also serves, as it naturally should, as a tabular view of the classification of butterflies in general, and finally he discusses the geographical distribution of butterflies, and in a few last words points out to the student how such a diversified region as New England received its butterfly population, especially how an Alpine summit, such as that of Mt. Washington, was peopled with its Arctic-like forms, the *Œneis semidea*.

In the preparation of these chapters, the author has evidently drawn very largely on knowledge acquired through his individual observations pursued for a number of years. So far from being in any sense a compilation, it is a fresh and original treatment of a most interesting theme, replete with many facts heretofore unpublished and unknown to the scientific public. The presentation of the subject is nearly always clear and simple, and the illustrations are, in many cases, original, and adds materially to the interest and value of the text. There is a good deal of inequality in the figures, the woodcuts, particularly those borrowed from the works of Harris and Riley, have been well printed; but by a false economy a number of figures prepared for photographic reproduction, however originally well prepared by the artist, do not print well, and we do not see how shaded drawings of this kind ever can be made to present a respectable appearance by the side of good woodcuts, though simple outline sketches print well enough.

Without farther enumerating the excellent features of the book, together with its good paper, neat typography and its general usefulness to the student, we will only say that it is a matter of congratulation that so original and stimulating a book has appeared; that it is a credit to American science, and that it is unique in its nature, no such work, so far as we know, being in existence in England, France or Germany.

[1] *Butterflies: their Structure, Changes and Life-histories, with special reference to American forms.* Being an application of the "doctrine of descent" to the study of Butterflies, with an appendix of practical instructions. By SAMUEL H. SCUDDER. New York, Henry Holt & Co., 1881. 12mo, pp. 322, with 201 figures.

The special student of butterflies, and the general student of Lepidoptera, will doubtless find fault with some statements and conclusions in the book. The author divides the butterflies into four "families," which we should regard as sub-families; he splits up genera to what seems to us to be a most extreme degree, and quite unnecessary in a book designed for popular use, where only the leading groups need to be emphasized, and the subordinate groups may be suppressed; why should the old name *Papilio* be given to what every one knows by the name of *Vanessa antiopa*, and the genus *Papilio* cut up into a genus for nearly each species; the rule of priority is an excellent one, but in rare cases, and especially such as this, need not be relentlessly followed. The old genus *Hesperia* has been also remorselessly subdivided. If this was done in the lower families of moths, as it could be on the same grounds, it would result in a burdensome and useless list of generic names. Is it not better to indicate such subdivisions rather by numbers than names; and cannot the systematist leave a little margin for the movements of nature in what at best is a direful straight jacket? We deplore the present extreme tendency to analytical views in classification; and believe that the results of catholic, extended study over different orders and classes of animals, and especially of variations in species and genera, induces more conservative and synthetical methods.

Among minor points which we should indicate, is the account of the development of the embryo on p. 11, which does not seem to us to be either clear or exact; on p. 14 in his account of the mouth-parts of the caterpillar, the author needlessly bewilders the student by speaking of the "astonishing number of moveable organs," when there are primarily but three pairs of such organs; it seems to us that this portion is less clear and simple than the succeeding chapters. It has been pretty well shown by embryologists that there are four segments in the head of winged insects corresponding to the four pairs of jointed appendages, viz., the antennæ, mandibles, and first and second maxillæ. Where are we to look for more? This is the view which has been presented in this country, and which is based on the study of hexapodous insects of different orders; and it seems to us the figures of early embryos by Kowalevsky supports the view that there are four rather than five primary segments in the head; the eyes being developed upon the antennal segment, and the labrum and clypeus forming simply the front or facial wall of the œsophagus.

The work is claimed by the author to be an application of the "doctrine of descent" to the study of butterflies, and so it is when he considers the transformations and physical structure of these beautiful creatures, but why does he rather illogically, on p. 101, oppose the only apparent natural explanation of instinct, as the result of inherited habits? How can we conceive of the gradual development and evolution of the hundreds of species and genera from some primitive prototype, and not suppose that the butterfly mind of to-day differs in some respects from the mental traits of primeval butterflies, which had a different environment, different food plants and different enemies, and which must have practiced different arts and stratagems in their struggles for life from those of their descendants?

Newton and Jenney's Geology of the Black Hills of Dakota.[1]—This posthumous volume is a worthy monument to the memory of Mr. Newton, a young and promising geologist, who died before completing the main portion of the report, including the first three chapters. Chapter IV on the mineral resources, and V on the climate and resources, are by Mr. Jenney; these were, by resolution of the U. S. Senate, called for in advance of the final report, and with a preliminary map were published in the spring of 1876; the field work occupying the four summer and early autumn months of 1875. It will be remembered that Gen. Custer's famous reconnoisance was made in the summer of 1874.

The Black Hills were first geologically explored by Dr. F. V. Hayden, who made a rapid examination of the geology of the foothills and extremities of the region during the exploration of Lieut. (now Gen.) G. K. Warren, in 1857. Dr. Hayden remarked as the result of his observations, that the Black Hills of Dakota would form one of the most interesting studies on this continent, and that in all the western country he had never seen the Cretaceous, Jurassic, Triassic or red-bed, the Carboniferous and Potsdam rocks so well exposed for study as around the Black Hills, and he spoke of the desirability of a careful detailed topographical and geological survey of this range. The gold discovered under Custer, led the Government to order a geological survey of this region, and the results are placed before the people in this elaborate and valuable report.

Mr. Newton thus speaks of this isolated group of mountains: "Elevated as they are like an island above the surrounding sea of the plains, and separated by more than one hundred miles from the nearest spur or sub-range of the Rocky mountains, the Black Hills are a complete study in themselves. Exhibiting in the strata exposed, and in the general character of the elevation, most of the principal features of the geology of the Rocky mountains, they are a geological epitome of the neighboring portions of that great range. The geologist, therefore, finds in this region a monographic study of universal interest, and by the regularity of the uplift, by the absence of great faults in the strata, and by the splendid exposures of the sedimentary rocks, he is given a piece of mountain geology of great beauty, simplicity and ease of elucidation.

"Usually in explorations in the West or elsewhere, the field of

[1] *Department of the Interior. U. S. Geographical and Geological Survey of the Rocky Mountain Region.* J. W. Powell in charge. Report on the Geology and Resources of the Black Hills of Dakota, with atlas. By Henry Newton, E.M., and Walter P. Jenney, E.M. Washington, 1880. 4'o, pp. 566.

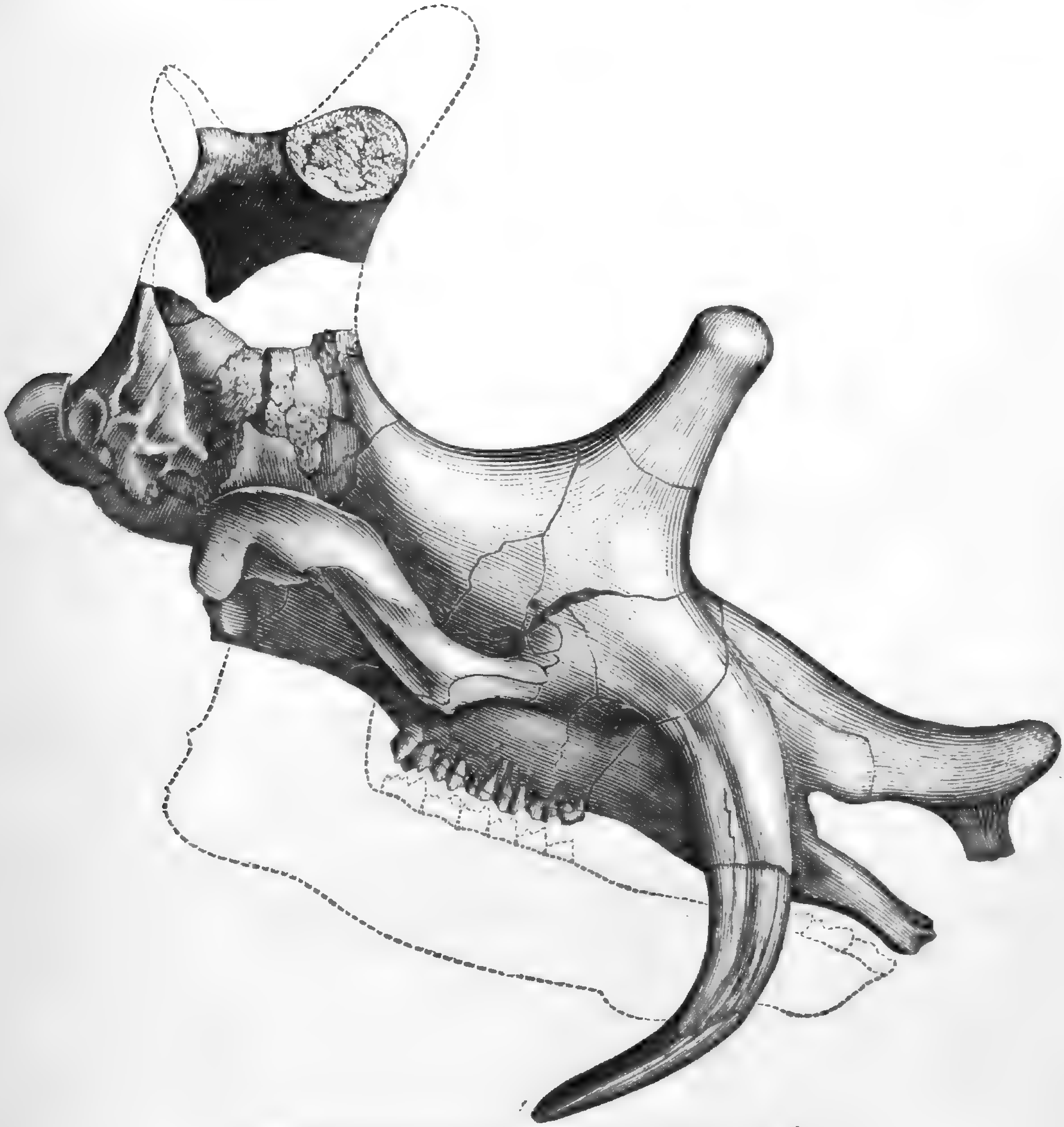
work of the geologist at any one time or season is but a part, and commonly a very small part, of a great system that extends over vast areas of country. Thus, in explorations in the Rocky mountains, the most assiduous labor of the geologist can cover thoroughly, in one season, but a small part of the great range, and his discussion of results cannot be complete in itself, but must depend largely upon work in the adjoining regions. Rarely then, does the geologist find his work so admirably circumscribed by nature as did those to whom the exploration of the Black Hills was committed. * * * Generally and simply the geological structure of the Black Hills is as follows: Around a nucleal area of metamorphic slates and chists, containing masses of granite, the various members of the sedimentary series of rocks, the Potsdam, Carboniferous, Trias or red-beds, Jura, Cretaceous and Tertiary, lie in rudely concentric belts or zones of varying width, dipping on all sides away from the elevatory axis or region of the Hills. From the Hills outward the inclination of the beds gradually diminishes until all evidence of the elevation is lost in the usual rolling configuration of the plains. At numerous points, also, within the area of the Hills, are centers of volcanic eruption of an age probably coincident with that of the elevation of the mountains themselves."

The chapters by Mr. Newton, who died of typhoid fever at Deadwood, in 1877, were revised and prepared for the press by Mr. G. K. Gilbert, while the report is preceded by an appreciative biographical sketch prepared by Professor J. S. Newberry.

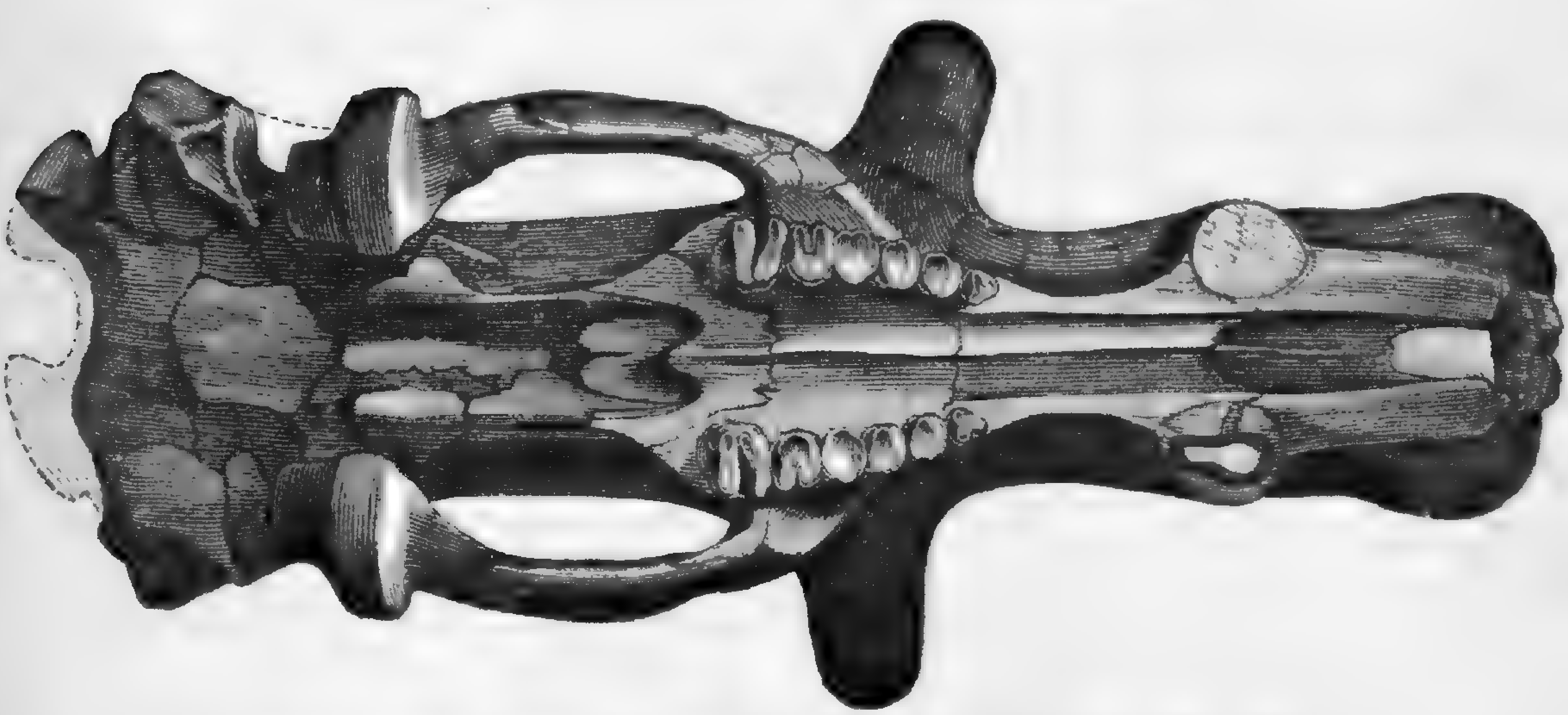
The palæontology of the report, accompanied by sixteen elaborate plates of fossils, is by Mr. R. P. Whitfield; an essay on the microscopic petrography of the Black Hills, with two fine colored plates, is by John H. Caswell; while Professor Asa Gray offers a brief enumeration of the plants, and Mr. Horace P. Tuttle reports upon the astronomy and barometric hypsometry of the Black Hills.

A Memoir on the Loxolophodon and Uintatherium, by Henry F. Osborn, Sc.D.[1]—This fine memoir opens auspiciously the quarto series of Contributions from the E. M. Museum of Geology and Archæology of the College of New Jersey. The fine series of specimens of *Dinocerata* obtained by the Princeton Scientific Exploring Expedition are here described and partly figured. A third species of *Loxolophodon* is described under the name of *L. speirianum*, which, judging from the figures given, was not less extraordinary than the other species of the genus. A good deal of light is thrown on the structure of these animals, especially as to the characters of the lower jaw. A note from Professor Guyot introduces the publication series, and a sketch of the Bridger beds of the Washakie basin closes the book.

[1] *A Memoir upon Loxolophodon and Uintatherium.* By Henry F. Osborn, Sc.D. Accompanied by a Stratigraphical Report on the Bridger beds in the Washakie basin. By John Bach McMaster, C.E. 4to, pp. 54, IV plates, II maps. Published by the Museum, Princeton, 1881.



Loxolophodon cornutus Cope. One-eighth nat. size.



Loxolophodon cornutus Cope; from below. One-eighth nat. size.

HERVEY'S SEA MOSSES.[1]—In the September NATURALIST we had the pleasure of calling attention to the publication of a much needed help to the student of sea-weeds in Dr. Farlow's "Marine Algæ of New England and the Adjacent Coast." It is gratifying to be able now to add another book to the list of those devoted to the beautiful inhabitants of the sea, the "sea-mosses," as they are popularly called. The Rev. A. B. Hervey, long a student and admirer of these plants, has just brought out his "Sea Mosses," in which he has attempted to make "a book which should be a real and helpful guide to those who, though not expert botanists, and not having or using any aids to a good pair of eyes other than a simple pocket magnifier, desire to begin the collection and study of marine plants." The book is thus, to a great extent, designed for amateurs, and for those who, spending a few weeks at the sea-side, want to know somewhat about the pretty plants which are washed up by the waves.

The introductory chapter includes somewhat about scientific names, classification, geographical distribution, times and places for collecting, mounting and preserving, methods of study, clubs and classes, and an historical sketch. This chapter alone is well worth the price of the book to the sea-side visitor, that portion treating of mounting and preserving being especially well treated. A chapter each is given to the Bright green Algæ, the Olive-colored Algæ and the Red Algæ. The general order followed is that "adopted by Dr. Farlow from Professor Thuret, in his list of North American Algæ." Keys are given which readily lead the student to the genera. The species are described in simple language, and many little interesting items are thrown in which add much to the value of the book. Twenty colored plates, most of which are very good, representing twenty-four species, are bound into the book. These are engraved from photographs of specimens in the author's herbarium, so that they represent real plants. A short glossary and an index of genera and species close this pretty book, which is tastefully gotten up by both printer and binder. We trust that both author and publisher will be amply repaid for their venture in trying to give to Americans a popular book on a scientific subject.—*C. E. B.*

BAILEY'S HANDBOOK.[2]—This neat little book will prove a most useful one to many students and teachers of botany. The author was fortunate in securing the aid, in particular subjects, of such men as Professor C. H. Peck, who contributed the article on Fungi, Charles Wright on Cactaceæ, Professors D. C. Eaton, W. H. Brewer, Edw. Tuckerman, and others. A chapter is given to

[1] *Sea Mosses;* a Collector's Guide, and an Introduction to the study of Marine Algæ. By A. B. HERVEY, A.M. S. E. Cassino, Boston, 1881.

[2] *The Botanical Collector's Handbook.* By W. WHITMAN BAILEY, B.P., Olney Professor of Natural History (Botany) in Brown University. Naturalists' Handy Series. Geo. A. Bates, Salem, Mass., 1881.

such topics as the collector's outfit, the vasculum, portfolio, map, lens, trowel, note-book and pocket-knife. The instructions are clearly given in an attractive manner. In the second chapter, under Fieldwork, and How to use the Portfolio, very many excellent hints are given. The section on Cactaceæ is especially valuable. Mosses (from notes by T. P. James), Lichens and Algæ are treated of in the succeeding sections. Professor Peck's section on collecting and pressing Fungi occupies fourteen pages, and it need scarcely be said that it is one of the most valuable in the book. Chapter III is devoted to closet work, including pressing and poisoning. In Chapter IV, the herbarium, labels, cases, economic collections and botanic gardens receive due attention. An excellent list of general systematic works, special floras (North American), floras of other countries, general works and botanical journals is given. The final chapter on public herbaria describes briefly a few of the herbaria of this country.—*C. E. B.*

Book of the Black Bass, by Dr. J. A. Henshall.[1]—This volume gives a full account of the appearance and habits of the two species of *Micropterus* which inhabit the fresh waters of the United States, together with directions to the angler, and many notes of interest to the sportsman. The book is well illustrated, and is, to our thinking, the most agreeably written fisherman's book yet produced in this country. We recognize in the author a sportsman of the best type, as well as a naturalist who has studied his subject *con amore*. We make two criticisms on two points for which the author is not responsible. The so-called family of "*Centrarchidæ*" is not yet distinguished from the *Percidæ*, and is not worthy of adoption. The specific name "Dolomieu," given to one of the species by Lacepéde, appears to us not usable in that form. It is, indeed, not now usable at all, for it was a popular French equivalent for a scientific specific name, which Lacepéde in fact never gave. This was not an uncommon custom with the older French naturalists, and generally their popular names have been translated into classic specific names, and thus partly preserved. It is, however, entirely optional with later naturalists whether they do this or not, and as in this case it was not done until several other good names had been given, there is no necessity for adopting this inelegant sobriquet.

North American Mesozoic and Cænozoic Geology and Palæontology, by S. A. Miller.[2]—This is an octavo volume of 338 pages, which contains, in Mr. Miller's language, "an abridged

[1] *Book of the Black Bass.* Comprising its complete Scientific and Life History, together with a practical treatise on Angling and Fly-fishing, and a full description of Tools, Tackle and Implements. By James A. Henshall, M.D. 8vo, pp. 464, 11 plates, cuts. Bound. Published by Robert Clark & Co. Cincinnati, 1881.

[2] *North American Mesozoic and Cænozoic Geology and Palæontology.* By S. A. Miller. Published by the Cincinnati Society of Natural History. 8vo, pp. 338. (October, 1879.) Cincinnati, 1881.

history of our knowledge of the Triassic, Jurassic, Cretaceous and Tertiary formations of this continent." This description consists in part of extracts compiled from the writings of American geologists, and in part of the author's own observations. It forms a valuable synopsis of the subject, and the references to the palæontology will be especially welcome, since it is the only compilation of this work in existence. Such a work deserves especial commendation, since American naturalists are generally precluded from taking it up owing to the pressure of new work. It is to be hoped that Mr. Miller will be able to accomplish for the extinct vertebrates what he has already done for the invertebrates, in his synopsis of the described genera and species. Mr. Miller's views as to the glacial period are very pronounced. He does not find any evidence of the existence of such a period in North America, either in the stratigraphy or the fossils.

On the Structure and Development of the Skull in the Batrachia, Part iii, by Wm. Kitchen Parker, F.R.S.[1]—This is the latest of Professor Parker's memoirs, which form a series of much value. The study of the morphology of the vertebrate skull has always possessed a high interest, and Professor Parker's contributions have added much to our knowledge of it. The present part refers to the *Anura*, and includes descriptions of numerous species and genera. Of the anatomical work we can speak in terms of high praise. Unfortunately Professor Parker has not been able to learn, from his researches, the true relations of the contents of the order of *Anura*. This is seen in his adherence to the system of Günther, which is, in every respect, worthless; and in his entire ignorance of the work of American naturalists on the subject. In this country the osteology of the *Anura* was understood sixteen years ago, and the classification was then placed upon a positive foundation. Professor Parker's knowledge of the literature is evidently not what it should be. The memoir is illustrated by forty-four beautifully executed plates.

Recent Books and Pamphlets.—Notes on the Vertebrata of the Preglacial Forest Bed Series of the East of England. Part iv. Rodentia and Insectivora. By E. T. Newton, F.R.S.

Notes on the Vertebrata of the Pre-glacial Forest Bed Series of East of England. Part v. Proboscidæ and Cretacea. By E. T. Newton, F.R.S. 8vo, pp. 8. From the Geological Magazine, June and July, 1881. London, 1881. From the author.

Proceedings of the United States National Museum. 8vo, pp. 34. Washington, 1881.

Proceedings of the Academy of Sciences, Philadelphia, July 1881. pp. 15. Philadelphia, 1881.

Proceedings of the American Association for the Advancement of Science, Twenty-ninth Meeting, held in Boston, Mass., Aug., 1880. 8vo, pp. 800, plates, cuts. Published by the society, Salem., 1881. From the society.

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[1] *On the Structure and Development of the Skull in the Batrachia.* By William Kitchen Parker, F.R.S. Part iii. 4to, pp. 266, 44 plates. From the Philosophical Transactions of the Royal Society. Published by the Society. London, 1881.

Further notes on the Pollination of Yucca and on Pronuba and Prodoxus. By C. V. Riley. 8vo, pp. 34, cuts. From the Proceedings of the American Association for the Advancement of Science, Aug, 1880. 1881. From the author.

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GENERAL NOTES.

BOTANY.[1]

An Interesting Lady's Slipper.—Professor Bastin, of the University of Chicago, describes and figures, in a recent number of *The Druggist*, a two-flowered specimen of the large Lady's Slipper *(Cypripedium spectabile)*, which he found while botanizing last June in the region at the southern end of Lake Michigan.

[1] Edited by Prof. C. E. Bessey, Ames, Iowa.

One flower was of the normal form, but the other was almost perfectly regular. "It had all three sepals distinct, and of equal size; it had no 'slipper' or lip, but the three nearly equal petals were shaped alike, differing from the sepals only in being a little narrower, and, of course, alternating with them. The ovary, which in most Orchidaceæ, and all other Cypripediums, is twisted through half a revolution, in this case was not twisted at all, and it was only slightly, instead of conspicuously bent to one side, so that the flower faced more nearly upward than in the ordinary form. The column, as usual, consisted of united stamens and pistils, but it was much less bent to one side, and the union of parts was not nearly so complete. There were three distinct anthers instead of two, alternating with the lobes of the distinctly three-lobed stigma. Instead of one large, dilated, triangular, fleshy body, apparently occupying the place of the third stamen in the ordinary form, and heretofore supposed in fact to be homologous with the third stamen, there were two of these bodies alternating with the petals, and evidently belonging to a distinct whorl. They may really be the homologues of stamens, but if so, the plan of the flower contemplates two distinct sets of stamens, with three in each set. Or we may, perhaps, with better reason, regard them as petals belonging to an inner whorl that alternates with the first."

THE CONIFERS OF JAPAN.—Dr. Maxwell T. Masters publishes in the *Journal of the Linnean Society* for July, a valuable paper on the Conifers of Japan. Thirteen genera are represented, and of these one, *Sciadopitys*, is peculiar to Japan; two, viz: *Cryptomeria* and *Cephalotaxus* are peculiar to Japan and China. *Ginkgo* is supposed not to be a native of Japan, although often cultivated. Of the forty-one species enumerated, no less than twenty-two (which are indicated by an asterisk in the subjoined list) are peculiar to Japan, and this fact leads Dr. Masters to infer "that Japan may have formed a special center whence Conifers have migrated elsewhere." The species given, omitting varieties, are the following: **Thuja dolabrata* L., **T. Japonica* Maxim., *T. orientalis* L. (*Biota orientalis* Endl., the Chinese arbor vitæ of the gardens), **T. pisifera* Masters (*Retinospora pisifera* Seib. et Zucc.), **T. obtusa* Masters (*Retinospora obtusa* Seib. et Zucc.), *Juniperus rigida* Seib. et Zucc., **J. nipponica* Maxim., *J. littoralis* Maxim., *J. taxifolia* Hook. et Arn., *J. chinensis* L., *Cryptomeria japonica* Don., **Cephalotaxus pedunculata* Seib. et Zucc., *C. drupacea* Seib. et Zucc., *C. umbraculifera* Seib., **Taxus cuspidata* Seib. et Zucc., **T. tardiva* Laws., **Torreya nucifera* Seib. et Zucc., **Podocarpus Nageia* R. Br., **P. cæsia* Maxim., **P. appressa* Maxim., *P. macrophylla* Don., **Sciadopitys verticillata* Seib. et Zucc., *Pinus densiflora* Seib. et. Zucc., *P. Thunbergii* Parl., *P. parviflora* Seib. et Zucc., *P. koraiensis* Seib. et Zucc., *P. cembra* L., var. *pumila* Parl., *Picea Maxmowiczii* Regel, **P. polita* Carr., **P. Alcockiana* Carr., *P.*

ajanensis Fischer, *P. Glehnii* Fr. Schmidt, **Tsuga Sieboldi* Carr., **T. diversifolia* Masters, *Abies firma* Seib. et Zucc. (includes also the forms hitherto known as *A. bifida* Seib. et Zucc.), **A. brachyphylla* Maxim., *A. Veitchii* Lind., *A. Sachaliensis* Masters, **A. homolepis* Seib. et Zucc., **A. Mariesii* Masters, **Larix leptolepis* Endl. The value of this paper is greatly enhanced by numerous excellent figures, and by what appears to be a full list of the numerous synonyms under which these plants have been known. It cannot fail to receive attention from the growers of Japanese Conifers in this country, and it is to be hoped that it will serve to better the nomenclature of these trees in the gardens and catalogues of our nurserymen, to say nothing of its use among botanists themselves.

A Pocket Manual of Botany Wanted.—Why has not some enterprising book-publishing house given the army of collecting botanists in this country a neat little pocket manual of botany? Every one who has ever collected at all (and what botanist has not?) has felt the need of carrying a manual with him to enable him to call to mind certain peculiarities which require examination in the field; but the burden of carrying a rather large and somewhat heavy book on a long jaunt, is often too much in addition to the load of plants, so the book remains behind. If we had a little pocket edition of, we will say for example, Gray's Manual, printed on thin paper, in small type (agate or pearl), bound in flexible covers and trimmed close to the margins, there is no reason why every student and collecter might not always have with him this much valued guide. A collector needs to have his manual with him in the field, just as much as the engineer needs his "field book," and the style of the well-known Henck's Field-Book might profitably be taken as a model by our book makers.

Lemna polyrrhiza again discovered in flower on the Detroit river.—On July 24, 1881, after an interval of ten years, I have again found *Lemna polyrrhiza* L., in flower, in great abundance, in the same pond on Belle Isle, in the Detroit river, Michigan, in which my first discovery (of July 30, 1871) was made, my specimens at that time determining the fact, which had been disputed, that the flower contained two ovules. (See American Naturalist, Vol. 5, p. 652.) The flowers were in every stage of development, some being in bud (the stamens still enclosed in the spathe), some in full blossom, while others were past or gone to seed. The shade of overhanging growths, such as wild rice, pickerel weed, blue flag and Sagittaria, seemed to favor the production of the flowers, they being found more abundant when thus situated, the frond, as I have observed, being at the same time reduced in size. As might be expected, in clusters representing fronds of various stages of growth, the older fronds were the flowering ones.

At 4 h. 15 m. P. M. both stamens were expanded; but closed at night, when I placed them in a vessel of water. At 7 o'clock next morning they had commenced to expand, three sets of flowers being in that condition. At 7 h. 45 m. A. M. eighteen had expanded, while by 8 h. 30 m. over thirty sets of flowers had opened, remaining so all day. They invariably closed towards night. In each instance one of the two stamens was always in advance of the other in ripening its pollen.

Kept in water, for two weeks they continued to blossom, though gradually going to seed. At the end of that time no more flowers were produced, though the plants were not taken from the water for drying till August 17th, or about three and a half weeks altogether. The young plants were produced proliferously in large numbers, falling to the bottom of the vessel.

In 1871, at the west end of this pond, I found *L. polyrrhiza*, *L. trisulca* and *L. minor* in flower at the same time, the first named being largely in the majority. While at the other end of the pond *L. trisulca* was found in blossom, associated with flowerless *L. polyrrhiza* and *L. minor*, the latter two being greatly in the minority. At the present time *L. minor* has totally disappeared, and there are only a few stray depauperate specimens of *L. trisulca* to be seen, *L. polyrrhiza* being evidently the victor, having driven out the other species and taken possession of the pond, which, this year, owing to excessively dry weather, is greatly reduced in size.—*Henry Gillman, Detroit, Michigan.*

BOTANICAL NOTES.—Charles S. Dolley, student in the medical department of the University of Pennsylvania, has rendered an excellent service in translating Cohn's brochure on Bacteria. The translation is well done, although the German idiom is often retained, sometimes a little awkwardly. A good plate, borrowed from the *Microscopical Journal*, is added, and some foot-notes are appended. The opening sentence of the translator's preface furnishes the reason for this attempt: "Why scientific and medical books, above all others, should not be published in cheap editions in this country, as they are abroad, is a query that has occurred to me at various times since the beginning of my medical studies." It is to be hoped that this translation will be followed by others from the same hand in the near future.——The August and September numbers of the *Torrey Bulletin* are unusually rich in important papers. We note the following in the August number. "Notes on Gymnosporangia," by Dr. Farlow; "Fern Notes," by G. E. Davenport, describing *Tænitis lanceolata* R. Br., discovered this year on Old Rhodes Key, Fla., by A. H. Curtiss; "New Species of North American Fungi," by J. B. Ellis, describing *Valsa tuberculosa*, *Lephiostoma tingens*, *Sphæria funicola*, *S. latebrosa*, *S. gallophila* *S. defodiens*, *S. Mertensiæ*, *S. leiostega*, *S. Eckfeldtii*, *Meliola maculosa*, *Asterina nigerrima*. In the September number E. L. Greene, in "New species of plants, chiefly

New Mexican," describes *Astragalus Gilensis*, *A. mogollonicus*, *Potentilla subviscosa*, *Megarrhiza Gilensis*, *Senecio cardamine*, *S. Howellii* and *Polygonum Parryi*; Professor Eaton continues his valuable notes "New or little known Ferns of the United States," and describes a fern from Florida (discovered by A. H. Curtiss), *Aspidium trifoliatum* Swartz, not hitherto known in the United States; G. E. Davenport's note on "Vernation in Botrychia," is interesting as recording the case of "two Botrychiums whose buds have thrown a doubt, for the first time in my experience, on the reliability of the bud-form as a test for the determination of the smaller species of the genus;" W. H. Leggett describes the curious bellows-like structure of the anthers of *Rhexia Virginica*, by means of which the pollen is actually blown out upon the body of a visiting insect!——The September *Gardener's Monthly* contains an interesting account, by Thomas Meehan, of the snow plant (*Sarcodes sanguinea*) of the Sierras. As a result of many examinations it is determined to be "an annual, germinating on small pine roots, and subsequently obtaining subsistence from the earth, as *Aphyllon* and *Epiphegus* do.". In the same number Mr. Meehan records the receipt of specimens of horseradish seeds, which are very rarely seen; these came from Maine.——A new tree fern, *Cyathea monstrabilia*, from Jamaica, is described by G. S. Jenman, in the September *Journal of Botany*. The trunk is four or more feet in height, and three inches in diameter.——C. M. Vorce, in the *Am. Mo. Microscopical Journal*, describes, rather vaguely, the wholesale destruction of acari by some fungus, which may have been some species of *Entomophthora*.——Holt & Co., N. Y., have just brought out an American edition of McNab's Botany, revised by C. E. Bessey. As issued, it includes within one compact 16mo volume, the morphology and physiology, and the outlines of classification which composed the two books of the English edition. In introducing it to American students in second or middle class schools, the editor hopes "that it may serve to direct attention to the study of plants as living things, rather than to their bare analysis and classification."——Geo. A. Bates, of Salem, Mass., offers for sale bound copies of Dr. Farlow's new book, "The Marine Algæ of New England and the Adjacent Coast."——Joseph F. James' short paper on "The Century Plant," read before the Cincinnati Society of Nat. History, contains a number of interesting facts about this valuable plant. ——E. Lamson Scribner, of Girard College, Philadelphia, has undertaken to publish sets of the grasses of North America in fascicles of about one hundred species each. Specimens in quantity are solicited from all parts of the country, especially from the far South and South-west. Those donating specimens for this work will receive sets, more or less complete, according to the quantity and value of their contributions. The first fascicle is promised for January next. It is sincerely to be hoped that Mr.

Scribner will receive such encouragement as will enable him to carry to a successful conclusion a work of so much importance. ——Dr. N. L. Britton has compiled for the Geological Survey a "Preliminary Catalogue of the Flora of New Jersey." It is printed on alternate pages, the blank pages being intended for notes, additions and corrections. J. B. Ellis furnished the list of Fungi, A. B. Hervey the marine Algæ, and Francis Wolle, the fresh-water Algæ, and T. F. Allen the Characeæ. The notes are valuable, and in many cases are quite full. Copies (to be returned in 1882) may be obtained by addressing the State geologist, Professor Geo. H. Cook, New Brunswick, N. J.

ZOÖLOGY.

THE RESEMBLANCES AND DIFERENCES OF THE TWO SEXES, by M. G. Delaunay.—This is the title of a paper published in the *Revue Scientifique* for September 3, 1881. It has special interest as presenting the most complete review of the differential characters of the sexes of the human species which has appeared. The author's conclusions are curious and instructive. We give a necessarily much abbreviated synopsis.

The author commences by showing that the female is much the larger and more powerful in most of the lower animals. He cites the Cephalopoda, certain cirripeds, most annelids, most insects—as Hymenoptera and Lepidoptera. Among vertebrates the female is the larger among many fishes and reptiles. Among the higher *Vertebrata*, the relations are reversed. In birds, except in a few birds of prey, the male is the larger, and this is universally the case among *Mammalia*. This superiority of the male sex consists in the following points: In the male the phenomena of nutrition are the more intense. The blood is denser and redder, and contains more red corpuscles and hæmoglobine, and fewer white corpuscles and less water. Malassez has proven that man has a million more red corpuscles in a cubic millemeter of blood than woman. Man eats more than woman. The public charities know that it costs more to feed a boy than a girl. Nevertheless though she eats less, woman eats more frequently. In the asylums the women take food from the table, thus doubling the number of their meals.

Respiration is more intense in man than in woman. In a man and woman of equal size, the man has a demilitre more pulmonary capacity.

Man absorbs more oxygen, though he breathes less frequently. According to Quetelet, between the ages of fifteen and fifty, woman has one inspiration per minute more than man. At all ages man excretes more carbonic acid than woman. The temperature of man is more elevated than that of woman. In the circulation, the blood-pressure is stronger in man than in woman, but the pulse is less frequent. The differences in several animals are as follows: in the lion 18 pulsations per minute; the ox, 10; the sheep, 12; and 10–14 in man. The anatomical preëminence of the male is especially in the functions of animal life.

The skeleton of woman is lighter in proportion to her total weight than that of man. It has been discovered that the male skeleton contains more inorganic matter than that of woman, and more carbonate of lime and less phosphate of lime. The woman uses the right side less than the man. According to Livon the left shoulder blade is larger than the right in woman, as in the inferior races. Broca found that the length of the clavicle as compared with the humerus is greater in woman than in man, as it is greater in the negro than in the white race. Man as is well known, is larger than woman, and also more heavily built, although the adipose coat of woman frequently gives an opposite impression to the observer. Among the Indo-European nations, woman is more prognathous than man.

The difference between the voices of man and women are perceptible among many of the higher animals. The inferiority in muscular energy on the part of women amounts to one-third the force exerted by the male. Muscular movements are more precise in man; this is seen in pianists, the best of whom are men.

The skull is more voluminous in the male. Wiesbach found its cubic contents in German women and men to be as 878 to 1000. Morselli compares the capacities as 85 to 100. According to Broca the difference in favor of man is 150 centimeters for the French and 211 for the Parisians. In woman the skull is generally more elongate and less elevated.

The brain of man is heavier than that of woman, not only absolutely but relatively. The size of woman to that of man being as 927 to 1000, the weight of her brain is to that of man as 909 to 1000. When of equal size, the brain of woman is much less heavy than that of man. The mean weight of seventeen male brains exceed that of as many brains of females of the same size, by 172 grammes. There are also differences of conformation. According to all anthropologists (Broca, Wagner, Huschke), the frontal lobes are less developed in woman. Huschke found fifty-four cubic centimeters difference in favor of man. On the other hand, the occipital lobes are more voluminous in woman than in man. According to Wagner, the female brain is always in a more or less embryonic condition. Some anatomists think that the right brain is more developed in woman and the left in man. This will explain why, in passing, man generally chooses the right hand, and woman the left.

After a discussion of the metaphysical qualities of the sexes, the author presents a view of their peculiarities in different races. His conclusions are as follows:

"The preëminence of the female sex, only seen in certain inferior races of men, and in the infants of the higher races, marks an inferior stage of evolution.

"It is the same with the equality of the sexes, which is only seen in little developed individuals, as inferior races and species, young persons, the aged, and in inferior classes of society.

"On the contrary, the preëminence of the male over the female represents a superior phase of evolution, since it characterizes superior species and races, adult age and the superior classes of society.

"From the moral as from the physical side, evolution appears to have progressed from a state of superiority of the female to that of the male sex; and the stage of equality represents an intermediate stage."

On the Morphology of the Corbula of certain Plumularidæ.—The specialized portion of the stem of the Plumularidæ which bears the sexual organs and which, from its likeness to a basket, is known as the corbula, has been compared by the greatest authority on the hydroids, Professor Allman, to a metamorphosed pinna, while the ribs of the same have been likened to the changed mesial nematophores of the pinna. Although this comparison has much to recommend it in *Aglaophenia spinosa* All., and some others, it is certainly not the homology of the corbula in all genera, as I have shown in my report on the deep sea hydroids of the *Blake* (Bull. Mus. Comp. Zool., Vol. VIII, No. 7). The true morphology of the corbula in these new genera, and the facts which support it, may be stated briefly as follows:

In the new genus Pleurocarpa, collected off St. Vincent by Mr. Agassiz, we have a true corbula homologous with a hydroid *branch*, and not with a modified pinna. In it the so-called corbula ribs are modified pinnæ and not comparable with metamorphosed nematophores. Showing that such is the case, we find in this genus that the proximal end of a branch which bears the corbula assumes the normal form of a corbula, while the distal extremity retains the true character of a branch with pinnæ unchanged. This genus seems to me to indicate, without doubt, that the corbula is a modified branch, bearing as ribs metamorphosed pinnæ instead of being, as taught by Allman, the homologue of a pinna with developed nematophores forming corbula ribs.

When now we come to study another genus of Plumularidæ, in which the protection of the sexual organs also assumes the form of a corbulæ, we find verifications of the same morphology which has been shown to be true in Pleurocarpa. The distal ends of the branches in Hippurella are true corbulæ, while the proximal portions are normal branches and bear primæ regularly arranged, imparting to the whole an unquestionable likeness to a branch. Indeed, no one can for a moment question that here these organs are metamorphosed branches, although some doubt may arise as to whether the distal ends are true corbulæ or not. If we compare Hippurella with Callicarpa Fewkes, all question as to the latter point is silenced, for in Callicarpa we have a structure which is undoubtedly a true corbula similar to that of Hippurella.

In Callicarpa we have a hydroid with simple stem, bearing pinnæ arranged regularly and alternately along its whole extent. On the main stem from which these pinnæ spring, there also arise corbulæ which closely resemble in shape spikes of wheat or barley. At that point on the main stem from which these arise there is no variation in the normal arrangement of the pinnæ, and no omission of a single pinna such as would be expected if the spikes were modified pinnæ. The corbulæ arise like any branch, and in their arrangement on the stem, no less than in their shape, bear every resemblance to metamorphosed branches.

The genus Callicarpa has still another interesting resemblance to Hippurella bearing on this homology. While the latter genus has the distal extremity of the branch modified into a corbula, and the proximal end remains normal with true pinnæ, Callicarpa has the whole branch changed in the same way, and it is destitute of those proximally placed pinnæ which characterize the corbula of Hippurella.

In conclusion, considering the corbula of the three genera, Pleurocarpa, Callicarpa and Hippurella, we are led to give to it a different homology from that which has been suggested for the same structure, as I believe, in some species of Agalophenia. The strongest evidence in support of my theory is found in Pleurocarpa, where the corbula is undoubtedly a modified branch. Are we to suppose that the corbula is not homologous in different genera, or that in one genus it is a modified pinna, while in another a metamorphosed branch?—*J. Walter Fewkes, Cambridge, September, 1881.*

Migration of Birds at Night.—The vexed questions regarding the migrations of birds and whether they fly by night and at great elevations have been elucidated by Mr. W. E. D. Scott, in the Bulletin of the Nuttall Ornithological Club for April. While, with some friends, looking through the 9½ inch equatorial at Princeton, N. J, at the moon, his attention was arrested by numbers of small birds, more or less plainly seen, passing across the field of observation. Most of the birds were the smaller land birds, among which were plainly recognized warblers, finches, woodpeckers, and blackbirds, the relative numbers being in the order of kinds given. Among the finches Mr. Scott identified *Chrysomitris tristis*, and the blackbird was the *Quiscalus purpureus*. With rare execeptions, the birds were seen to be flying from north-west to south-east. By observing the height of the moon above the horizon in degrees and the two limits of the area of observation—that is, how near or how far the birds noted were from the glass—it was found, with the aid of Professor C. A. Young, that the birds flew at the great elevation of nearly 10,000 feet, and that the average number of birds passing through the field of observation per minute was four and a half. In commenting on these fact, Mr. J. A. Allen remarks that Mr. Scott's novel and important observations definitely establish several points in relation to the migration of birds that have heretofore rested almost wholly on conjecture and probability. "We have, first, the fact that the nearest birds seen through the telescope must have been at least one mile above the earth and may have ranged in elevation from one mile to four miles. It has been held that birds, when migrating, may fly at a sufficient height to be able to distinguish such prominent features of the landscape as coast-lines, the principal water-courses, and mountain-chains over a wide area. Of this, thanks to Mr. Scott, we now have proof. It, therefore, follows that during clear nights birds are not without guidance during their long migratory journeys, while the state of bewilderment they exhibit during dark nights and thick weather becomes explainable on the ground of their inability to discern their usual landmarks—points that have been assumed as probable, but heretofore not actually proven."

Braving the "Blizzards."—On the last day of March I visited the Iowa Agricultural College, at Ames, Story county. I walked over from the station and back, and while returning my path lay across a little knoll, from which the snow had disappeared, though it still covered half the country around. Near the top of this knoll a little bird flew up from the dry grass at my feet. Through a "survival" of the old habit of boyhood, of searching for the nest on the spot whence a bird rises in this way, I instinctively stopped and looked, and there, on the ground, was a neat little nest, in the bleached prairie grass, containing three small speckled eggs! Great patches of snow and ice lay in all the hollows near at hand, while a most terribly cold wind was blowing from the north! It was a dreary, bitter day, and March was really going out like a roaring lion! Really, it did not seem to me that the snow could have disappeared from the knoll more than three or four days before. Later still more snow fell, and to-day, as I write this item, I am "snow-bound" seventy miles west of my home! That little winter snow-bird (*Plectrophanes nivalis*, as I suppose) no doubt understands her business, but I should say she had set about rearing a family under circumstances of extreme difficulty! It would seem that the younglings must perish from the lack of insect food, if they escaped freezing to death—though in the adult state they live on the seeds of our prairie weeds. At all events I never found a bird's nest during a March "blizzard" before.—*Charles Aldrich, Webster City, Iowa, April 12, 1881.*

SNAKES CLIMBING TREES.—It seems to be in order, just now, for any person who has ever seen a snake "up a tree," to narrate the happening in some of the natural history papers. In 1863, while our regiment was stationed at Columbus, Ky., several of us made an excursion to the battle-field of Belmont, just over the river. While riding along through the woods, I heard a slight rustling just over my head. I was under a pawpaw tree, and looking up I was not a little surprised to see a small grass-green snake resting confidently upon the twigs and leaves not a foot from my face! The reptile was up seven or eight feet above the ground; but how it got there I had no means of knowing. Of course it "climbed" by some means. This tree was about six inches in diameter, and the bark was quite smooth. The timber, however, was very thick at this place, and the snake may have ascended some other tree better adapted to the purpose of a road-way. These little snakes were quite plenty in that portion of Dixie, and are often found in this vicinity. They are eighteen to twenty or twenty-four inches in length, grass-green on the back, and greenish-white on the under side. I do not know any name for them, either popular or scientific, but I suppose any herpetologist would readily identify them from the above description.—*Charles Aldrich, Webster City, Iowa, May, 1881.*

THE BLUE JAYS.—These birds remain with us all the year round, notwithstanding the temperature of *minus* twenty-nine or thirty degrees which we sometimes have in our long "blizzard" winters. Supposing from their continued presence here that the bird is a resident, and not at all migratory, I was not a little surprised to-day to see a large one feeding another about one-third smaller in size. A member of my family had witnessed a similar act a few days ago. It occurred to me that possibly this might be an old bird with its young, which had been reared in some warmer region during the past winter. Migrating here, the young birds were only receiving the care they would seem still to need. It would seem hardly possible that the old bird had been taking care of this one all winter, else we should have seen something of the kind before. It is an unusual thing, I think, for old birds to be seen feeding young ones at this season, when most species are building their nests.—*Charles Aldrich, Webster City, Iowa, May 12, 1881.*

DOES THE CROW BLACKBIRD EAT CRAYFISH?—One of my students, who has during the past summer been making some observations upon the nature of the food of the "crow" blackbird (*Quiscalus purpureus*), brought me to-day the contents of one of their stomachs, and wished to know what kind of seeds they were that were mixed with the remains of insects, &c. Upon examination I found that the so-called "seeds" were gastroliths, or stomach stones of the crayfish. There were twenty-six of these stones in the stomach of that one bird, with no other traces of crayfish remains. I can hardly believe that the bird had eaten thirteen crayfishes, or if it had, that the gastroliths should be all that remained of them in the stomach. Can it be that the bird finds these objects so plenty about the water's edge that it swallows them to serve as general stones in the "gizzard?" Since Mr. Aldrich has shown (see the October NATURALIST) that this bird feeds upon live fish, it may be that it also eats the crayfish, but even that supposition would hardly account for the presence in its stomach of so many of these peculiar bodies, with none of the other parts.—*F. E. L. Beal.*

AVIAN RIDERS.—Dr. Merrill's interesting account of the belief of the Crow Indians that a small bird, probably a grebe, performs its migration on the back of the sandhill crane, was no doubt new to our readers. It appears, however, that a similar belief is widely spread among various tribes of North American Indians. Dr. Merrill's account referred to the Crows, but he mentioned also that the Crees entertained the same belief in reference to the white or whooping crane. Recently, in the London *Nature*, Mr. John Rae gives an account of the supposed passage of certain small birds on the back of the Canada geese, as related by the northern Indians, which he apparently believes in.

It is generally asserted by the Naskegon Cree Indians, who dwell about the south-western part of Hudson's bay, that a small bird, one of the Fringillidæ, performs its northward migration in spring on the back of the Canada goose (*Bernicla canadensis*).

This species reaches Hudson's bay about the last of April, and the Indians state that when the geese are fired at the little birds are seen flying away from them. The Indians in this region devote considerable time each spring—a month or more—wholly to goose shooting, and their method of doing this is to set decoys near a blind and to call down the geese as they are passing over. It is inferred from this that such geese having rested upon the ground or having passed near by it have been deserted by their little passengers.—*Forest and Stream.*

THE MIGRATION OF BIRDS.—In a valuable article on this subject in *Scribner's Magazine* for October, Mr. J. A. Allen concludes: 1st. That the habit of migration resulted from changes of climate occurring at a not very remote geological period. 2d. That every gradation exists between species the most widely roving and those which are strictly sedentary; and that even representatives of the same species may be either migratory or sedentary, according to whether they occupy, as breeding stations, the northern or southern portion of the common habitat. 3d. That failure of food induces a movement towards warmer regions. 4th. That the return of birds to their breeding stations, which are their only true homes, is prompted by the recurrence of the season of procreation and strong home affection. 5th. That they usually pursue definite routes, and are guided in part by prominent landmarks, or by memory, and in part by "instinct" or inherited experience. 6th. That erratic movements are the result of transportation by storms. 7th. That birds discern approaching meteorological changes.

THE CLAW ON THE INDEX DIGIT OF THE CATHARTIDÆ.—Birds form such an eminently distinct group in the present age—one so thoroughly isolated from any of the other natural divisions, that the discovery of any new factor in their anatomy, belong to what system it may, that tends to bring them nearer, by structural affinities, to one or the other of the great classes in nature, must always be regarded with peculiar interest by comparative anatomists. A prominent example, of this, familiar to all of us, presents itself in the discussions and special attention that the remains of *Archæopteryx macrura* has always received from such of us as are interested in special homologies, and by naturalists generally.

The writer has been recently engaged in collecting together, from various sources, material from which he hopes, at no distant day, to produce a monograph upon the osteology of the Cathartidæ. Not long ago a skeleton of *Catharista atrata* was obtained, through the kindness of Mr. Robert Ridgway, from a friend in Florida—after it had been received at the Smithsonian Institution. Mr. Ridgway and myself were examining it together, discussing in a casual way some of the bird's osteological bearings, and features, when my ornithological friend called my attention to an appendage at the extremity of the index digit—an addition to this vulture's skeleton, that was at once recognized as a delicate and freely articulated *claw*. Our surprise was mutual, and an examination of the many specimens of vulturine birds, skins and skeletons, that the Museum afforded, and which were within our easy reach, was at once inaugurated. The results of this and subsequent studies of the hands of these birds, it is my object to record in the present paper, believing as I do, that this feature has thus far escaped the scrutiny of descriptive ornithologists. Moreover, I cannot recall any representative of our avi-fauna that exhibits any such addition to the ordinary bones of the manus—in fact, the examples of birds in which it exists, are by no means common. We are all well aware that several genera of plovers, found in different localities over the world, can boast of a spur attached to the manus below the carpal joint, usually, I believe, on the metacarpal bone. This is also the case in *Parra jacana* and Palamedea, and others, but in these birds, as I have just stated, it is essentially an immovable *spur*, the counterpart of the same appendage as found on the posterior aspect of the tarso-metatarsus in the common barn-yard fowl and game cock—and as in these birds, often used as a weapon of attack during the breeding season.

So we must regard these spurs as nothing more than weapons possessed by a limited number of favored genera, given to them for a definite purpose, as hard as it is for us to conceive why some birds should wear them, to the exclusion of others—but claws, particularly as they occur in the Cathartidæ, have a very different significance,—they may mean a great deal more. They are to all intents and purposes, useless to their owners—and the problem simply presents itself to us, as to how they came by them—when did they first appear, and how? what are they the rudimentary remains of? and much more that may forever be purely conjectural ground for us, but certainly constituting a view of the subject that lies beyond the scope of such an essay as this, to treat or enter into.

The only authority that comes to my mind at present, who describes these affairs in any general way, is Professor Owen, and this writer dismisses the subject in the following manner:

"The index digit in Struthio and the medius digit in Apteryx, support each their claw. The claw or spur, when present in other birds, *e. g.* Syrian Blackbird *(Merula dactyloptera)*, spur-winged goose *(Anser gambensis)*, knob-winged dove (Didunculus), jacana *(Parra jacana)*, mound-bird (Megapodius), screamer (Palamedea), is developed from the radial side of the metacarpus, or from the index digit. The screamer has two spurs, the homotypes of the metatarsal ones in *Pavo bicalcaratus*. The claw upon the index of Archeopteryx was curved and sharp; and the remains of the unique example of this ancient fossil bird make it probable that the hand had a second free unguiculate digit, perhaps the homolodge of the pollex. Although the instances of these weapons, and the occasional use of the wings in birds not so armed, *e. g.* the swan, show them in the light of means of attack, the bones of the pectoral limb in birds are modified mainly for volant action."

At the present writing there are two rather imperfect skeletons of *Pseudogryphus californianus*, and two mounted specimens, the latter being unquestionably "birds of the year," in the Smithsonian Institution. In the younger, or at any rate the smaller of these last, we find this claw present and very prominent, though it occurs in both birds. It can be immediately brought into view and examined, by simply parting the feathers that overlie the region of the first finger, whereupon it will be found to be a strong curved claw—convex anteriorly, sharp, slightly grooved from above downwards on its posterior aspect, covered by the same kind of horny integument, or thecæ, that shields the bony claws of the feet, and movable. It measures in this case, along the axis of the curved anterior surface, something over a centimeter (about 1.3 centimeters), being grasped about its base by the common integuments of the upper extremity. Its horny sheath being removed, it leaves an osseous claw, such as we find in the distal or ungual points of the feet; this has a transverse facet at its base, that articulates with a similarly placed surface at the extremity of the index digit, rather towards its outer side. It is supported in addition to the aid the common skin affords, by ligaments attached to the bone above. It is not uncommon to find a slight inequality in size, when the claws of the two sides are compared in the same specimen—this remark holds good for other individuals of the family. No doubt, when we come to examine a larger series of specimens, this appendage will be found to differ in size according to the age, or perhaps in some cases the idiosyncrasy of the individual. In *Sarcorhamphus gryphus*, it was seen to possess all of the characteristics just described as they occur in our Californian Condor, only that in the first it was not found to be nearly so large, nor so much curved. It does not appear to attain any very great size in *Sarcorhamphus papa*, where also it becomes still less curved.

In a specimen of *Catharista atrata* that I have before me, this claw is subcompressed from side to side, sharp behind, rounded anteriorly, slightly curved from before, backwards, and occupies a facet on the anterior third of the extremity of the index digit. In other birds examined of this species, this rule was departed from, in the claw being apparently less curved, and flatter; in this seemed to be its constant condition in *Cathartes aura*.

Turning to the vultures of the Old World, which we are aware have been placed with the Falconidæ, this claw could in no instance be found; neither Neophron, nor *Gypogeranus serpentarius* exhibit any such feature, in short, it seems to be confined, as far as the vultures are concerned, to our family of Cathartidæ, and as here developed, constitutes an additional character, referable both to external features and internal structure, for deferential diagnosis, separating these birds from the Old World vultures. —*R. W. Shufeldt, M. D., Washington, D. C.*

The Paper Nautilus again in New Jersey.—I have to report for the third time, the discovery of an Argonauta on the New Jersey coast. It was found in September at Long Branch, the day after President Garfield's death, and near the cottage in which he died. The shell was fresh, its occupant having but recently perished. The two previously reported by me were found in August, 1876, one at Long Branch, containing the animal alive, and the other at Point Pleasant, about fifteen miles south. This, too, was a fresh shell. Thus, beginning with the summer of 1876, we may set down the Argonaut as belonging to the marine fauna of New Jersey; and query: As this beautiful creature is a native of the Tropics—" what's up!" Has the Gulf Stream got a new kink?—*S. Lockwood, Freehold, N. J., Oct. 12, 1881.*

Zoological Notes.—The type of a new family of fresh-water worms, remotely allied to the Lumbriculidæ and Tubificidæ have been discovered by G. Eisen in a small rapidly flowing spring among the snowy peaks of the Sierra Nevada in California. The worm is described in a memoir, with two colored plates, in the Transactions of the Royal Society of Sciences in Upsala, for 1881. The worm is named *Eclipidrilus frigidus,* and the family Eclipidrilidæ.——The second part of M. Jules Macleod's contribution to the study of the structure of the ovary of Mammals refers to that of Primates. He has also published in the Bulletin of the Academy of Sciences of Belgium, abstracts of the results of his investigations on the reproductive apparatus of bony fishes, especially the ovary of Hippocampus and of Sygnathus.——It will be remembered that elephantiasis and other diseases allied to leprosy are supposed by Dr. Lewis and others to be contracted in India and China from drinking unfiltered and unboiled water containing the embryos of Filariæ, minute thread worms found in the circulation of leprous patients, which are introduced into man by drinking cold uncooked water, as well as by the mosquito, which serves as an intermediary host. Dr. P. Manson, of Amoy, has published in the Journal of the Queckett Microscopical Club, a notice of a chart recording a series of observations on the blood, temperature and pulse of two Chinese lads, ascertained to be filarious, and which were in the main made by themselves. He concludes, 1st, that the periodicity observed by the Filaria embryos is by no means an exceptional or capricious phenomenon; and 2d, that it is associated with the advent of night, not depending in any way on the sleeping state. Dr. Manson concludes as follows: "If the examination of filarious blood is made during the night, it is almost as easy to find the parasite as it is to find a white blood corpuscle. Seeing this, and the frequency with which the presence of the parasite is associated with lymphatic fever, elephantoid and other disabling affections, I have sometimes thought it would be worth the trouble for the government in India to institute the systematic examination of the blood of native recruits by their medical officers."——In the same periodical Mr. J. G. Waller argues that the so-called boring sponge (Cliona) does not make the burrows in which it is found growing, but that an Annelid is the factor. To this Mr. Priest demurs, who claims what is generally accepted by zoölogists, that the Cliona does the work. He thinks the protoplasm of the sponge acts on the surrounding parts, and eats its way into them, as the protoplasm of necrosis eats into bone.

ENTOMOLOGY.[1]

THE PERMANENT SUBSECTION OF ENTOMOLOGY AT THE RECENT MEETING OF THE A. A. A. S.—The Entomological Club of the A. A. A. S., which has had several most interesting and instructive meetings, was made a permanent subsection of the Associa-

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

tion at Boston last year, and with the adoption of the amendments to the constitution at Cincinnati, has become part of the Section (F) of Biology, and will meet in future, when the number of entomological papers will warrant, as a subsection thereof. At the recent meeting there were few papers presented; indeed, but a single title had been entered up to the first day, and the editor of this department, who had decided to enter none, owing to his duties as general secretary, was induced to change his mind, upon this discouraging showing. The distinctive feature of the club was its meeting a day in advance of the Association, when excellent opportunity was offered for the interchange of views and the exhibition and exchange of specimens. After the business of the Association once begins, there is so much to interest and occupy members that it is more difficult for the specialists to get together. In this one respect the merging of the club into the Association—the loss of its independence, so to speak—is a drawback; but we hope that it will not lessen the enthusiasm or interest of the entomologists of the country, who still have in the Association an incentive to annual reunions that cannot but prove both pleasant and profitable.

Among those in attendance were the chairman, Jno. G. Morris, the secretary, B. Pickman Mann, and Messrs. J. A. Lintner, Wm. Saunders, Wm. H. Edwards, J. D. Putnam, Cyrus Thomas, V. T. Chambers, S. H. Peabody, H. S. Jewett, Charles Dury, A. J. Cook, C. G. Siewers, Jno. A. Warder, C. D. Zimmermann, E. W. Claypole.

The following is a list of the papers entered and read:

Life-history of the Buckeye stem-borer, *Sericoris instrutana* Clem. E. W. Claypole.

Retarded Development in Insects. C. V. Riley.

New Insects injurious to American Agriculture. C. V. Riley.

The Egg-case of *Hydrophilus triangularis*. C. V. Riley.

On certain habits of *Heliconia charitonia*. W. H. Edwards.

On the Oviposition of *Prodoxus decipiens*. C. V. Riley.

The Cocoon of Gyrinus. C. V. Riley.

On the length of life of Butterflies. W. H. Edwards.

On the life duration of the Heterocera (moths). J. A. Lintner.

A remarkable invasion of Northern New York by a Pyralid insect, *Crambus vulgivagellus*. J. A. Lintner.

On an alleged abnormal peculiarity in the history of *Argynnis myrina*. W. H. Edwards.

How does the Bee extend its Tongue. A. J. Cook.

The Syrian Bees. A. J. Cook.

Carbolic acid as a preventive of Insect Ravages. A. J. Cook.

Suggestions of coöperation in furthering the study of entomology. B. Pickman Mann.

The subsection was opened by the reading of Mr. Edwards's paper on a singular habit of *Heliconia charitonia* Linn., recently observed by Dr. Wm. Wittfeld, near Indian river, Fla. In two instances Mr. W. found three or four of these butterflies brooding, so to speak, over a chrysalis of the same species, clinging to it tenaciously by their legs, and resenting all attempts to frighten them away until the imago had issued from the chrysalis. This brooding would last for two or more days. We know of no similar action of a butterfly on record, and the statements elicited from Mr. Edwards in the discussion of his paper, left the impression that the butterflies could not have congregated around an injured chrysalis to obtain its juices, but that they really gathered around it for protection, on the hypothesis that the imago possessed some peculiar immunity from the attacks of birds and other enemies not possessed by the chrysalis. If this hypothesis should in future prove to be correct, the action of this species will denote a remarkable degree of intelligence in butterflies.

In the afternoon the genial and venerable president read his address, which contained feeling tributes to those entomologists who passed away during the year, and an admirable bibliography of the writings of the year by American entomologists. His allusion to the death of Professor S. S. Haldeman was quite tender, giving some reminiscences of years ago, when he and Haldeman were very intimately associated in favorite studies. He rapidly sketched some leading features of the scientific life of his late friend and delivered a eulogy upon his character appreciated by all who had any acquaintance with him.

Dr. M. also gave a sketch of the condition of entomology as it was 40 years ago, when there were not known to be more than 10 or 12 working entomologists in the country, whose names he enumerated. At present, there are 436 names reported in last year's Naturalists' Directory of persons who are designated as entomologists. There is no other distinct branch of zoölogy that has so many representatives in that book except geology and botany. The lists of all contributions to entomology for the last year in the various journals, exclusively by American writers, numbered 336, and of writers 80.

Mr. Edwards's paper "On the length of life of butterflies," showed, from his own experience of fifteen years, that the life in the imago state, in summer, spans but a few weeks, depending somewhat on the period when coition occurs; while those which hibernate as imagines may of course endure eight or ten months. Citing *Danais archippus* as an illustration, he criticised the statement in reference to it in Mr. Scudder's recent work on butterflies, where Archippus is made to live from twelve to fifteen months, and to oviposit only after hibernation. Mr. Edwards's experience shows that in West Virginia the broods of Archippus follow in quick succession to the number of three or four, and that during the summer the eggs are laid by young females soon after issuing from chrysalis. Mr. Riley stated that his experience in reference to this species in the Southwest, corroborated that of Mr. Edwards, and expressed the belief that it did not hibernate at all in the Northern States but migrated to the South in autumn, and dispersed northward the ensuing spring and summer, and suggested that this fact, not appreciated by Mr. Scudder, would throw light on the history of the species in New England.

Mr. Lintner's paper on a somewhat similar subject, viz., the life duration in Heterocera, gave a long series of careful notes of collectings, from which he concluded that the average duration of moths is from two to three weeks in summer. The paper gave rise to some extended remarks from Messrs. Thomas, Mann, Riley and others. Mr. Thomas thought that the knowledge of the term of life in the imago was of less value, from an economic standpoint, than that of the individual in all its states. In endeavoring to ascertain this duration in *Leucania unipuncta*, he had come to the conclusion that it was about seventy-seven days. This conclusion, based on calculations from recorded appearances of the insect, was in opposition to the only actual experiments which are on record, viz., those by Mr. Riley in the Eighth and Ninth Reports on the Insects of Missouri, which show that the term of life in summer hardly extends over half as many days. In fact, all our experience as to the summer duration of life in this species shows that each state of egg, larva, chrysalis and imago will average ten days. Mr. Thomas argued that insects in confinement develop more rapidly than in freedom. Mr. Riley gave his experience as opposed to the statement: insects reared in confinement during the summer are likely to develop more slowly than in freedom, for the obvious reason that those in freedom get more sunlight, and constantly have a supply of fresh food at hand, and this will hold equally true with the changes that take place underground, for the mean temperature of the soil, during summer, is evidently greater outdoors than indoors. Experience shows, moreover, that in this question everything depends on the time of year, character of the weather and other surrounding conditions, there being a wide range in the duration of life in the same species.—*(To be continued.)*

The New Imported Clover Enemy.—In the September number we gave a brief record of the appearance in injurious numbers of *Phytonomus punctatus* Fabr., a common European Curculionid hitherto unknown in this country. In looking up the literature on the habits of the insects of this genus in Europe, we find much written on the history of the earlier states of several species. From what is known in Europe, it appears that the species of the genus show a unity of habit and mode of development. The greenish larvæ (recalling in general appearance those of Syrphus or of some Tenthredinid larvæ), feed in May and June on the leaves and flowers of the plants they infest, and spin in July a net-like cocoon on various parts of the plant, changing therein to pupæ within eight to twelve days, the beetle issuing in July or August. Only one annual generation is recorded, the beetle hibernating. *Phytonomus murinus* Fabr., oviposits on the young shoots of Lucern *(Medicago sativa); Ph. meles* Fabr., feeds as larva and beetle on *Trifolium pratense* and Lucern, and proves injurious to the latter plant in some parts of Germany; *Ph. nigrirostris* Fabr. (which, by the way, occurs also, though rarely in the United States, from Canada and Massachusetts westward to Michigan), feeds as larva on *Trifolium pratense* and *Buphthalmum salicifolium*; *Ph. pollux* Gyllh. on *Silene inflata* and *Polygonum hydropiper; Ph. rumicis* Fabr., on various species of Rumex and also on *Polygonum aviculare; Ph. viciæ* Gyllh. on *Vicia sylvatica; Ph. plantaginis* DeG. on *Platago lanceolata* and *Lychnis dioica; Ph. polygoni* Linn., on young shoots of Dianthus and on *Polygonum aviculare*, the larvæ feeding on the leaves as well as on the blossoms and also boring in the stems; *Ph. suspiciosus* Hbst., on *Lotus uliginosus* and *Lathyrus pratensis; Ph. palumbarius* Germ., on *Mentha aquatica* and *Salvia glutinosa.* So far as known, the habits of the genus in this country conform to the above experience in Europe. We have reared *Ph. comptus* Say, from *Polygonum nodosum* upon which the larvæ and pupæ may be found in July, the cocoon having the usual net-work appearance. Of the nine species known to occur in this country (exclusive of *Ph. punctatus)* this is the only one whose habits have been observed, though, as above shown, those of *Ph. nigrirostris* have been recorded by European observers.

We had the pleasure of spending some time about the middle of August with Mr. L. D. Snook at Barrington, N. Y., who has suffered materially from the attacks of *Phytonomus punctatus*, and since—though it is so common abroad—little or nothing is on record of its habits, and since it has certainly never before been reported as injurious to agriculture, we give Mr. Snook's experience up to the time of our visit. In the latter part of April, he first noticed on a field of clover here and there, small patches where the leaves were badly eaten. The damage increased rapidly in extent, and by the end of July, the whole field (about seven acres) was badly infested, one corner of nearly two acres having scarcely a whole clover leaf remaining. Other fields in the neighborhood were attacked in the same manner, while an occasional field escaped injury. We found acres of his clover ruined, but in passing through the field none but an expert would suspect the cause, since the beetles were, as a rule, hiding on the ground or slightly beneath the surface, and the few that were feeding dropped and "played possum" upon the slightest approach, their color being so much that of the earth, that they are not easily observed. That they had been much more numerous earlier in the season than they then were, was apparent from the number of dead specimens more or less broken, and from the cocoons which had generally been washed by the rains on to the ground and more or less embedded. Judging from European experience we anticipated no further multiplication the present year; but, to our surprise, the beetles have been continuously laying eggs from that time to the present writing (October 3d), and what is more singular, while some of the eggs have been laid externally to the plant either singly or in little groups, most of them have been secreted and thrust into the old and hollow stems. A few of the larvæ which hatched externally are now nearly full-grown, but those which hatched within the stalk, have fed but little and are evidently preparing for hibernation. Is this a normal habit in Europe, or is it a departure therefrom consequent upon the introduction of the species here? The latter seems quite probable since the habit of attacking clover injuriously is certainly new, if we may judge from the failure to indicate it by European entomologists. The probability is that the insect with us will hibernate both in the larva state within the stem and in the beetle state. In either event the larvæ will doubtless be found most numerous in northern New York in the month of May, and we recommend that clover fields in which it is found be heavily rolled at that season, as the best means of decreasing its injuries.

Without going into descriptive details, we would state that the egg is elongate-oval, about twice as long as wide, pale yellow, and smooth when first laid, but becoming greenish-yellow, and roughened with hexagonal depression before hatching. The average length is 1^{mm} and in most cases the larva has hatched in about one week from the time the egg was laid. The young larva is pale with a dark head, but subsequently becomes greenish with a distinct whitish medio-dorsal line relieved by darker shades each side. The body is deeply wrinkled, with prominent substigmatal and ventral swellings, the latter so well developed and so extensile that they perform the function of prolegs, giving the larva its strong resemblance to those of Tenthredinidæ, and enabling it to easily crawl or clasp the edge of a leaf. When at rest it clings sidewise and in a curved position to the leaf, usually on the underside, grasping the leaf hairs between the ventral swellings but especially in the transverse fold of the anus, by which it can hold and swing the whole body about as Syrphid larvæ are known to do. The surface of the body is sparsely beset with short stiff hairs, varying in number at different stages of growth. The largest specimen, evidently about full-grown, has up to this writing (October 3d) experienced three molts.—*C. V. Riley*.

Crambus vulgivagellus.—This common moth which, as stated on page 750, is the parent of the worms that did so much damage to meadows in parts of New York. (See pp. 574 and 576.) has been excessively abundant all over the Eastern States this year, and as Mr. Henry Edwards informed us, proved a positive nuisance in collecting in the neighborhood of New York city. Professor Lintner has published a full account of it in the *Elmira Husbandman* for Sept. 14, 1881, in a paper presented to the N. Y. State Agricultural Society. He has also obtained the eggs, and from them a second brood of larvæ. We found the egg-shells quite common in the earth from some sward sent September 12th, by Mr. Adams, from a field that had been devastated by the larva, and we have since readily obtained fresh eggs from moths captured in Washington. The eggs are pale yellow when laid, but become orange afterward; they are elongate-oval, very slightly broader at base than at top, and ribbed as in those of various butterflies, there being about twenty longitudinal, rather sharp ridges and about thirty less marked transverse ones. The average length is 0.7^{mm} and diameter 0.3^{mm}. They are dropped singly among the grass and on the ground.—*C. V. R.*

LARVAL HABITS OF SPHENOPHORI THAT ATTACK CORN.—For many years several species of the genus Sphenophorus have damaged the corn crop in various parts of the United States, more particularly at the south, where they are all known as "bill bugs." Glover, in 1855, spoke of their injuries, but did not determine the species. Walsh, in 1867 (*Pract. Ent.*, II, 117), described a species damaging corn in New York as *S. zeæ*, but which subsequently proved to be *S. sculptilis* of Uhler. *S. sculptilis* also occurs in the South and West, being common in Illinois and Missouri. It has also been received at the Department of Agriculture from Florida and Alabama, *S. robustus* from South Carolina, and *S. parvulus* from Missouri, all as injuring corn. The larval habits of all these species are unknown. Walsh surmised that *S. sculptilis* would be found to breed in decaying driftwood washed by water, the adults migrating to neighboring corn-fields, and some subsequent facts that have come to our knowledge lend weight to his hypothesis so far as this particular species is concerned.

In reference to one of the larger species (*S. robustus* Horn), which has done considerable injury to corn this year in South Carolina, Mr. L. O. Howard, whom we recently sent down there to study it, found that it actually breeds in corn. On the plantations along the bottom-lands of the Congaree and neighboring streams, as soon as the corn appears in the spring it is attacked by numbers of the adult beetles. Stationing themselves at the base of the stalk, and also burrowing slightly under the surface of the earth, they pierce the stalk and kill many plants outright, leaving others to grow up dwarfed and distorted. The whole field has frequently to be plowed over and replanted. The eggs are probably laid at this time or a little later, at or near the surface of the ground. The young larva, hatching, works downwards, and may be found at almost any age in the tap-root. A few individuals work upwards into the first section of the stalk, but only, it would seem, after having consumed all available pith below ground.

At full growth the larva will have consumed the pith of the stalk for from four to five inches, dwarfing the stalk, preventing the make of the ear, and causing the lower leaves to turn brown and wither. The larva has the general characters of other described larvæ of the genus. The pupæ are found in cavities opposite the first suckers, surrounded by excrement compactly pressed so as to form a sort of cell.

The beetles make their appearance in the fall (one specimen issued as early as August 30), and hibernate as adults mainly in the stalks. The remedy then of cutting the stalks in fall or early winter and of plowing up and burning the stubble is obvious.—*C. V. Riley.*

Effect of Drought on the Hessian Fly.—It has long been known that the Hessian fly flourishes most when the Chinch bug flourishes least; in other words, that wet weather favors it. Moisture seems essential to the well-being of the larva. The prejudicial effect of drought has not hitherto been observed, that we are aware of, but was very noticeable the present year in parts of Ohio, where the puparia literally dried up. Our attention was first called to the fact of the general death of the insect in the "flax-seed" state by Mr. E. W. Claypole, of Yellow Springs, O., and our observations subsequently confirmed his experience. The intense heat had not only desiccated the Cecidomyia, but, what is still more remarkable, in most cases the parasites also. We should like to hear from Prof. Cook, of Michigan, and others, whether a like result followed the severe heat and drought in other parts of the West. The presumption is that the mortality was general and that farmers may expect immunity from injury for some years to come.

Simulium from Lake Superior.—In regard to the Simulium from Lake Superior, which we mentioned on p. 313, current volume of this magazine, Dr. Hagen remarks in the *Canadian Entomologist* (Vol. xiii, pp. 150–151), that upon examination of larvæ and pupæ, sent to him by Mr. H. G. Hubbard, they did not appear to differ materially from those of *S. pictipes*, but that the imagines from Lake Superior (which were not raised from the pupæ collected by Mr. Hubbard) differ from *S. pictipes* in their much smaller size and in the color of the legs.

Coleopterous Cave Fauna of Kentucky.—Mr. H. G. Hubbard has carried on during the past summer a careful investigation of the insect fauna of the different caves in Kentucky, especially near Cave City, and it is now pretty safe to say that the Coleopterous cave fauna of Kentucky comprises but two general viz: Adelops and Anophthalmus. Of the former genus only one species has been found which seems to be equally common in all caves in that State, but Mr. Hubbard thinks that in Anophthalmus we may expect considerable increase in the number of species when all our caves shall have been explored.

Hemipterological Studies.—Dr. V. Signoret kindly sends us the first part of his "Revision du groupe des Cydnides de la famille des Pentatomides," from the *Annales de la Société Entomologique de France* for 1881. It contains a review of what has been done in the classification of this family by former authors, a characterization of the family, table of genera (forty-three in number) and the beginning of the description of the species from all parts of the globe. Two plates accompany this part.

Entomology in Buffalo, N. Y.—We are very glad to see that the publication of the Bulletin of the Buffalo Society of Natural Sciences has been resumed after a lapse of several years. Vol. IV, No. 1, has just been issued and contains the following entomological papers: List of Coleoptera observed and collected in the vicinity of Buffalo, by F. Zesch and O. Reinecke; New Coleoptera, by John L. LeConte, M.D. (*Elaphidion imbelle*, *Oeme gracilis*, both from Poway, Cala., and *Myodites zeschii*, from Buffalo); Observations and Notes (on *Eudryas unio*, *Smerinthus modesta*, *Hylesinus trifolii*, *Cossus robiniæ*, *Papilio thoas*, *Thyreus abboti*). One plate accompanies this number, but we must confess that figures III and IV thereof are quite poor and inaccurate.

Lampyridæ.—Dr. LeConte has been kind enough to send us a copy of his long-expected "Revision of the N. A. Lampyridæ." This paper will no doubt be very welcome to every coleopterist in our country, as it renders determinations possible in a somewhat neglected but interesting group of beetles. We hope that it will serve to call attention to the many interesting points in the life-history of the Lampyridæ proper, yet to be made out.

Severe Cold and Hibernating Apple-worms.—Prof. A. J. Cook records having found that the larvæ of *Corpocapsa pomonella*, which hibernated under natural conditions, *i. e.*, in their silken cocoons in the cracks and crevices of the trees, had succumbed to the severe cold of last winter, while those hibernating in cellars and kitchens survived.

ANTHROPOLOGY.[1]

Temporal Process of the Malar Bone in ancient Human Crania.[2]—A noteworthy anatomical and possibly anthropological feature of a large proportion of the crania from the well-known ancient cemetery near Madisonville, Ohio, is the presence of a

[1] Edited by Prof. Otis T. Mason, 1305 Q Street, N. W., Washington, D. C.

[2] The Temporal Process of the Malar Bone in the ancient human crania from Madisonville, Ohio, by F. W. Langdon, M.D. Read before Am. Assoc. for the Adv. of Science, at Cincinnati, Aug. 22, 1881.

spine-like or occasionally unciform process, situated on the posterior border of the malar bone and partially covering in the temporal fossa.

This projection, for which the writer proposes the name *temporal process*, is somewhat triangular in form, its base, which is from 7 to 18^{mm} in length, being continuous with the middle third of the posterior border of the bone; it tapers somewhat rapidly to its rather obtuse apex, its average length being a little over 5^{mm}.

A similar process is of occasional occurrence in negroes and mulattoes, and further observations as to its distribution and frequency in various races would doubtless be of interest. The accompanying figure illustrates a fairly developed specimen as seen in many of the Madisonville crania.[1]

FIG.—Temporal Process of Malar Bone.

[The process described by Dr. Langdon may be noticed in plates 11, 12, 13, 15, 17, 18, 19, 23, 25, 28, 30, 31, 37, 41, 47, 55, 62 of Morton's Crania Americana. It is also a marked characteristic in many crania of the Army Medical Museum, belonging to many tribes and both sexes. It is not mentioned in any work with which we are familiar, and is worthy of further notice since it has been observed in such a large homogeneous group as the Madisonville find.—*Ed. Am. Nat. Anthrop. Dept.*]

A PREHISTORIC CUP MADE FROM A HUMAN CRANIUM.—A somewhat remarkable and possibly unique specimen of aboriginal handicraft has been recently exhumed by some curiosity-seeking boys, near Cedar Grove, Indiana, a small town situated on the Whitewater, about thirty-seven miles north-west of Cincinnati. On the 10th of October, 1880, they discovered a human skeleton, and with it, instead of the earthen pot so often found with such remains, was a cup or bowl made from a child's skull.

The skeleton, as described to the writer by one who assisted in taking it out, was in a sitting position, facing north-west, with the vessel at the left side on a level with the hips. The bones of the right hand and arm were missing, but I think had fallen with earth into a gully which had washed out on that side. The skeleton, which is that of an old and rather tall man, is in a fair state of preservation.

The vessel, or drinking cup, is, evidently, from its small size

[1] The dotted line indicates the ordinary contour of the posterior border of the bone.

and plainly marked sutures, the skull of a child. The base of the skull has been roughly cut away and scraped smooth, leaving an irregular margin or rim to the vessel. Both the inner and outer surface has been scraped with some rough-edged tool, leaving numerous scratches. Two holes were drilled through the side, near the upper part of the cup, for the purpose of mending a crack by tying the fractured parts together. A portion of the frontal bone was accidentally broken away by a stroke of the spade. This curious relic of barbarism is now in the collection of the writer, as is also the well-preserved skull with which it was found. Along the gully before mentioned, and within a few feet of these remains, were found parts of three other skeletons.

It may be added that the place where they were found, has, for many years, been known to be an aboriginal cemetery.

The situation is on the highest terrace formation, about one hundred feet above and immediately overlooking the Whitewater. The soil is compact clay about two feet thick, overlying clean, white sand, in which the bones were found.—*Edgar R. Quick in Jour. Cin. Soc. Nat. Hist.*

Anthropology at the American Association.—Although the dread of a terribly hot wave deterred many of the older members from going to Cincinnati, the meeting was very largely attended. The department of anthropology, inspired by the environment, drifted into archæology. It is to be hoped that the next meeting will witness a greater diversity of subjects. All the papers read are given below, with the name and address of the author, so that the readers of the Naturalist may, if desired, put themselves in correspondence with them:

Mallery, Col. Garrick (Washington, D. C.)—Opening address before the permanent sub-section of anthropology. Subject: The Gesture Speech of Mankind.

Mason, Otis T. (Washington, D. C.) — The uncivilized mind in the presence of higher phases of civilization.

Horatio Hale—A lawgiver of the Stone age.

———The history of Hiawatha.

Holbrook, Watson C. (Lebanon, O.)—Mound-builders' skeletons.

———Prehistoric hieroglyphics.

———Stone implements of the drift.

McAdams, Wm. (Otterville, Ill.)—The stone images and idols of the mound-builders.

———Some remarkable relics from the mounds in Illinois.

Dall, Wm. H. (Washington, D. C.)—On the inhabitants of N. E. Siberia, commonly called Chukchis and Namollo.

Henderson, Hon. J. G. (Winchester, Ill.)—Houses of the ancient inhabitants of the Mississippi valley.

———Was the antelope hunted by the Indians on the prairies of Illinois?

———*Ilex cassina*, the black drink of the Southern Indians.

———Agriculture and agricultural implements of the ancient inhabitants of the Mississippi valley.

Smith, Mrs. Erminnie A. (Jersey City, N. J.)—Comparative differences in the Iroquois group of dialects.

———Animal myths of the Iroquois.

Morse, Edw. S. (Salem, Mass.)—On the ancient Japanese bronze bells.

———On worked shells in New England Shell-heaps.

Hoffman, W. J. (Washington, D. C.)—On the interpretation of Pictographs by the application of gesture signs.

Trowbridge, S. H. (Glasgow, Mo.)—Exhibition of some archæological specimens from Missouri.

Langdon, Frank W. (Cincinnati, O.)—The temporal process of the malar bone in the ancient human crania from Madisonville, Ohio.

Peet, Stephen D. (Clinton, Wis.)—The emblematic mounds on the four lakes of Wisconsin.

———Buffalo drives on the Rock river in Wisconsin.

De Haas, Wills (Washington, D. C.)—The Mound-Builders; an inquiry into their assumed southern origin.

The greatest attraction, however, to the anthropologists, was an excursion by train to Madisonville, a few miles north of Cincinnati. The readers of the NATURALIST had been told so much concerning this wonderful locality, that about three hundred persons went to the ground to examine for themselves. There, in brief, they witnessed what a few determined gentlemen can do with limited resources. On a long tongue of land, bounded on all sides but one by deep and precipitous ravines, is the ancient cemetery. Beginning at the top end of the bench, the explorers have excavated about two acres to a depth of six feet, throwing the earth through sieves. Upwards of five hundred skeletons have been exhumed, accompanied with the usual vessels, etc. But the distinguishing feature of the cemetery is the ash-pits, cavities in the earth several feet in depth, where layers of earth and ashes alternate, but there are no evidences of fire in them. The implements in the pits, formed of bone and antlers, are as wonderful as the pits themselves. Many beautiful collections have sprung from this digging, among them we mention those of Dr. C. L. Metz, the Hon. Joseph Cox, Mr. C. F. Low, Dr. F. W. Langdon, Mr. E. A. Conkling, in Madisonville, and those of the Museum of the Society of Natural History and the private collection of Dr. H. H. Hill, in Cincinnati. The last named gentleman has, without doubt, one of the most extensive and intelligently classified private museums in the West.

ANTHROPOLOGY IN FRANCE.—There comes over us, when a great man dies, a momentary feeling of despair. What will science do now, we said, when Dr. Paul Broca laid down his pen? But into the great gap his pupils throw themselves, and the good work goes on. The July number of *Revue d'Anthropologie*, after an opening article by Dr. Broca, passes on to give us the accustomed rich and varied feast, the list of whose good things will be found below:

Broca, Paul—La Torsion de l'Humérus et le tropomètre, 386–425.

Betz, Wladimir (Professor a l'Universitié de Kiew)—Sur la structure de l'écorce cérebrale. A la Mémoire de Paul Broca.

Chassagne, Amédée—Contribution a l'Ethnographie de la Basse-Bretagne, avec cartes, 439–447.

Maget, Dr. G.—Sur les moeurs des Japonais.

Féré, Ch.—Nouvelles recherches sur la topographie cranio-cérébrale, 468–487.

Deniker, M.—A review of Weisbach's "Körpermessungen verschiedener Menschemassen," Berlin, 1878, pp. 448–502. [This is a very minute and valuable review of a work not in the hands of many American anthropologists.]

Zabarowski—Review of the following works: [Ernest Chantre, "Premier Age du fer.—Necropoles et tumulus" (1 vol. gr. in 4to, pp. 57, with album in folio, 50 plates.——Baron J. de Baye, "L'Archéologie préhistorique. Epoque tertiaire. Epoque quaternaire. Transition entre les deux epoques de la pierre. Epoque néolithique. Grottes artificielles de la Marne. Grottes à sculptures. Sépultures. Trepanation préhistorique. Fleches à tranchant transversal, etc." 1 vol. gr. 8vo, pp. 412, figs., Paris, 1880.——Urban & Virchow, Cemeteries of Gross-Lichterfeld, at Berlin," *Zeitschr.*, 1879, p. 342.——Dr. Anger, "The mixed cemetery of the plain of Neustadt near Elbing," *Zeitschr.*, 1880, II, p. 166.] pp. 503–516.

Topinard, Dr. Paul—Review of Tylor's "Anthropology."

Manouvrier—Review of the following: Enrico Morsalli, "Critique and reform of the methods of anthropology, founded upon laws statistical and biological, and upon experience," Rome 1880.

Lesson, H. and L. Martinet—Les Polynesiens, leur origine, leurs migrations, leur langage. Paris, E. Leroux, 1880. Reviewed in *Rev. d'Anthrop.*, IV, 1881, 524.

Zabarowski—Association française pour l'avancement des sciences. Session d'Alger, 1881. Section d'Anthropologie." pp. 530–536.

Manouvrier—Reviews the following: [Ettore Regalia, "Les anomalies numériques des vertèbres chez l'homme et leur interprétation."——Cesare Taruffi, "Observation du géant Chawang-in-Sing.]

Ten Kate—Review of Gegenbauer's "Discussion of the lachrymal bone in man, in *Morphologisches Jahrbuch*.

Kuhff, G.—Review of Dr. E. Schmidt's Kraniologische Untersuchungen,

GEOLOGY AND PALÆONTOLOGY.

EOCENE PLAGIAULACIDÆ.—This remarkable family of *Marsupialia* belongs, as is well known, to the Jurassic period, and genera have been found in both Europe and North America. Falconer traced resemblances to the existing *Hypsiprymnus* of Australia, and there might be some remote affinity between the families. But in the formations which represent the long period between the Jurassic and present ages, no trace of intervening genera has been found. It is therefore of interest that I am able to announce the discovery of such a one from the Lowest Eocene (perhaps Puerco) beds of New Mexico.. The specimen was found with the jaw of the *Triïsodon quivirensis* (NATURALIST, for August; 1881), and consists of a single tooth of the lower jaw. It is the characteristic obliquely ridged cutting tooth well known in *Plagiaulax*. It presents the following differences from those of *Plagiaulax* and *Ctenacodon*, which I regard for the present as generic.

Char. gen. Cutting edge convex and continuous with the anterior edge of the crown, and serrate from the union of ridges which ascend on each side. Ridges curved backwards, all reaching the edge excepting above the posterior root of the tooth, where they are discontinued, leaving a smooth edge. In *Plagiau-*

lax the ridges are continued to the posterior edge of the crown, and in *Ctenacodon* the ridges do not extend on the sides of the crown. In *Hypsiprymnus* the ridges are vertical.

Char. specif. The tooth is much larger than that of any of the *Plagiaulacidæ* yet known, exceeding the corresponding one of the kangaroo-rat of Australia. There are twelve ridges on the side of the crown, extending from the base. They are crowded anteriorly and become more widely spaced posteriorly. The anterior margin is acute from near the base; the latter projects a little beyond the root. The most elevated point of the crown is between the roots. Ridges fine, enamel smooth. Length of base of sculptured part of crown, .0062; elevation of do., .0047; thickness of do. at base, .0025. The genus and species may be called *Ptilodus mediævus.—E. D. Cope.*

BELODON IN NEW MEXICO.—Some years ago[1] I identified certain fossils discovered in North Carolina by Emmons as Belodons; and later,[2] referred a species found by Wheatley in Pennsylvania, to the same genus. I am now in a position to prove that the genus ranged over the Rocky mountains, and that there, as in other parts of the world, it haunted the shores of the Triassic seas and lakes. In the same region a related form, the *Typothorax coccinarum*, existed at the same period.[3] There are two species of *Belodon* in my New Mexican collections, one as large as the gavial of India, the other smaller. In the former the muzzle is keeled above, and rises into a crest in front of the nares. In the other species the muzzle is subcylindric, and does not rise anterior to the septum of the nostrils. The larger species I call *Belodon buceros;* the smaller one *B. scolopax,* and define them as follows:

Belodon buceros.—Size of the gavial. Muzzle slender, compressed, with a narrow median superior ridge, rising at the middle of the length into a compressed crest, whose summit is in the plane of the frontal region. Nostrils a little further anterior to the orbits than the diameter of the latter, longer than wide, and separated by a thin septum. Orbits round, looking a little upwards, the interorbital region a little narrower than each orbit. Preorbital region compressed; preorbital foramen large, inferior. The quadrate bones are directed forwards, and their articular faces are in the transverse line of the two rather narrow notches of the posterior outline of the parietal bone. The auricular meatus is bounded by a descending hook-like process; and the squamosal bone is continued still further posteriorly into a short triangular acute horn. The superior surface of this bone with the parietal and frontal, are roughened with tubercles. The palate has a strong ridge on each side, so as to be grooved. The posterior teeth have

[1] Proceedings Academy of Natural Sciences, Philadelphia, 1866.
[2] Transactions Amer. Philos. Soc., XIV, 1869.
[3] Cope, Report G. M. Wheeler, U. S. Surv. W. of 100th Mer., IV., 1877.

compressed denticulate crowns. Tip of muzzle lost. Total length preserved, M. .700; length of muzzle to posterior edge of nares, .420; do. from latter to lines of anterior edge of orbits, .060; do. from do. to posterior parietal notch, .160. Width at posterior border of quadrate condyles, .240; interorbital do., .048; do. at slender part of muzzle, .045. Depth of slender part of muzzle, .050; do. of elevated part, .120; do. at parietal region, .140.

This species is of the size of the *B. kapfi* Meyer, and is, in the form of the muzzle, intermediate between that species and the *B. plieningeri.*

Belodon scolopax. This species is represented by a snout, which includes the anterior border of the nares; it is broken into five pieces, which should be connected with intermediate fragments, which are lost. This muzzle is a little shorter than that of *B. plieningeri*, but is a good deal more slender, the distal part having only half the diameter of the latter. Besides this character, it differs from that of *B. plieningeri* in three others. The extremity of the muzzle is not so much decurved. All the alveolæ have a more lateral exposure, and the lateral ridges of the palate are thus more distinctly seen from the side. The two teeth on the extremity of the muzzle are closely crowded together, and their large alveolæ are scarcely distinct.

The surface of the muzzle is distantly and weakly grooved and punctate. The anterior alveolæ are round, the posterior ones oval. Diameters an inch anterior to nares; transverse, .0230; vertical, .0235. Diameters three inches from extremity; transverse, .019; vertical, .0145.

Geological Notes.—The third part of the Contributions to the Palæontology of Austro-Hungary, by Mojsisovics and Neumayr, contains two articles. These are, the Jura formation of the neighborhood of Brünn, by V. Uhlig; and the fossils of the Nizniow Limestone, by Von Alth.——The *Palæontographica*, for June, 1881, consists of a memoir on the extinct Elephants of Japan. The species mentioned are *Stegodon clifti*, *S. insignis*, *Elephas namadicus* and *E. primigenius*. The August number contains the first part of a memoir on the fauna of the Kelheim Diceras limestone.——Mr. Hulke, in the Quarterly Journal of the Geological Society of London, for 1879 and 1880, has described two new *Dinosauria* of the *Iguanodontidæ*, under the names of *Vectisaurus valdensis*, and *Iguanodon prestwichii.*——The *Revue Scientifique*, of Paris, gives a review of the last year's progress in vertebrate palæontology. It covers five pages and a half, of which one page is given to South American and four pages to North American works on the subject.——Prof. Cope's Palæontological Bulletin, No. 33, contains descriptions of fourteen new species of Mammalia from the Lowest Eocene beds of New Mexico. Eight new genera are characterized.——In the Bulletin of the Geological Society of France, M. Fischer describes a new Eocene Creodont under the name *Apterodon gaudryi.*——Dr. H. G. Seeley has recently re-examined the vertebrate fossils found at Neue Welt, near Vienna, and has made a number of important rectifications in the determinations.

GEOGRAPHY AND TRAVELS.[1]

THE OGOWÉ AND CONGO ROUTES TO STANLEY POOL.—The Royal Geographical Society's Proceedings, for August, gives some interesting details concerning M. de Brazza's expedition up the Ogowé. The ulterior object of this expedition was to open a route from the Ogowé to the Congo above the cataracts, and launch steam vessels on the navigable part of the latter stream. "The station founded at Ntamo [Stanley Pool] is intended as the starting point of the steam vessels which are shortly to be placed on the Congo, while that on the Passa affluent of the Upper Ogowè is the nearest point to the Congo which could be placed in direct communication by water with the Atlantic Ocean, some 435 miles distant. On his first expedition it took M. de Brazza two whole years to reach the Passa, which was previously unknown, and the obstacles to free commercial intercourse on the Ogowé were great, as the river was divided into three distinct sections, held respectively by the Inenga and Galoa tribes, the Okandas, and lastly the Adumas, each of whom exercised absolute control over their own section, so that three changes of porters and canoes were necessary, and the value of merchandise was thus enormously enhanced. But during his last journey M. de Brazza put an end to this arrangement which had existed from time immemorial, and made the navigation of the river free as far as Franceville, his station on the Passa. With regard to the 180 miles of land journey thence to Ntamo on the Congo, porters will be found as easily along the road as on the banks of the Ogowé, for the population is very dense and peaceable, and the surface of the country presents no serious difficulty; indeed were it not for some obstacles in the first three days' march, a wheeled vehicle might pass along the road without any preliminary labor being necessary. The country, moreover, is very healthy, as it consists of a plateau at an elevation of 2625 feet, and this altitude affects the vegetation beneficially, so that the banana and maize flourish there. But this line of land communication from one station to another is only a provisional expedient, for the route to be used in the future will touch the Congo at a point much nearer to Franceville. This route, by which the steam vessels will pass down to the Congo, is the river Alima, which in his former expedition M. de Brazza discovered at a point only forty-five miles from the Ogowé. The tract of country between Franceville and this point on the Alima is not difficult and, indeed, is almost practicable for laden wagons without any previous labor being

[1] Edited by ELLIS H. YARNALL, Philadelphia.

expended on it. Having traversed it five times already, M. de Brazza is able to speak confidently on the subject. The country is not wooded and the vegetation is sparse, the hills have a gentle slope and a wheeled vehicle could pass everywhere."

"M de Brazza justly prides himself on having been able to accomplish, without violence of any sort, the total abolition of the slave trade in the basin of the Ogowé. Franceville has already become a place of refuge for escaped slaves, and M. de Brazza states that all the tribes along the river recognize this right of asylum and admit that all slaves who place themselves under his protection are thereby made free." He speaks discouragingly of Mr. Stanley's operations, believing that his road on the north bank of the Congo will never become a practicable highway. "In a former geological age an immense plateau, at an elevation of more than 2000 feet above the level of the sea, separated the Upper Congo from the Atlantic; the river wore a bed for itself through this plateau, which at last, by the action of constant and continuous drainage, became furrowed into as many valleys as there were torrents rushing down into the great river. In following the line of the Congo, therefore, it becomes necessary to cross all these chains of mountains, which are the remains of the ancient plateau." * * * * "By the line of the Ogowé, the river is made use of as far as it is navigable for canoes, from which point it is but forty or forty five miles through an easy country to a point where the Alima is navigable for steam vessels. On this line, too, labor and provisions are drawn from the country itself, while on the Congo nothing but rocks and dry grass are to be found. Not only are the men of Mr. Stanley's expedition fed on rice from Europe transported on the backs of porters and mules, but the animals themselves are fed on hay and oats obtained from Europe at heavy cost." Mr. Stanley is compelled to obtain men from Zanzibar, but few of the natives being willing to work, while "at Franceville, on the other hand, the neighboring villages sent men to build the houses, and when M. de Brazza, in July of last year, had to send down the coast for supplies, the 750 Adumas who manned the canoes were only accompanied by one European and two Gaboon men. The natives here are paid in goods after working for three or six months. Sufficient labor could be procured on the spot to carry out any works between Franceville and the coast as well as between the Ogowé and the Alima, and this essential difference between the two routes is due to the Ogowé region being well peopled and the country fertile and new to European merchandise."

The French Government has organized another expedition, supplied with steam launches, to ascend the Ogowé to assist M. de Brazza, which, at last advices, had arrived on the coast.

The Great Andes of the Equator.—Mr. Edward Whymper has recently read a most interesting account of his journey in Ecuador before the Royal Geographical Society. It is given in full in the Proceedings for August. We have space here for only two extracts, the first relating to one of the principal objects of his journey; the comparison of the working of aneroid against mercurial barometers at great elevations, and also the value of calculations based on the boiling point of water; and the second regarding the glaciers of the Ecuadorian Andes. To test the value of the aneroid barometer, Mr. Whymper took with him eight instruments carefully selected, after a trial of twelve months, from a number of others.

"Upon leaving England they were well together, the greatest difference between them being about the eighth of an inch, or more exactly, .13. The value of this difference at the level of the sea amounts to about 100 feet; and if the mean of the whole had been taken, there would have been an infinitesimal difference between it and the reading of a standard mercurial. But by the time I arrived at Guayaquil this difference had increased to .35; on arrival at Guaranda [8900] it had still further risen to .74; at our first camp on Chimborazo [14,300] it had mounted to .88, and at our third camp [17,200] to 1.2 inch. These were the differences of those which held closest together, rejecting those which had clearly gone mad. They differed amongst each other at starting to the extent of 100 feet, and by the time we had risen to 17,000 feet, this difference had increased to about *two thousand* feet. If you consider that these were not aneroids selected at random, but were the pick of a number which had been expressly constructed for the journey, I think you will feel that this experiment conclusively demonstrated the uselessness of expecting to obtain absolute determinations of altitude from any number of aneroids; and, expensive as the experience was, I do not consider it dearly gained, as it decided that matter so far as I desire to pursue it, for once and all. The best of all ways to settle whether altitudes can be deduced with accuracy from the indications afforded by the boiling-point of water, would of course be to conduct a series of experiments on the boiling-point at positions the height of which had been determined with scrupulous accuracy trigonometrically; but the opportunities of doing this at great elevations are not numerous, and such experiments can be performed at heights exceeding 16,000 feet in India alone. The next best way is to compare them against the mercurial barometer and, as we had mercurials almost always with us, I took the opportunity to make experiments, with the result of finding that the boiling-point observations consistently yielded lower altitudes than the mercurial barometer, and I quote in illustration three of the highest stations at which water was boiled, namely, the summits of Cotopaxi, Antisana and Cayambe:

The elevation of Cotopaxi by merc. bar. was	19,650
" " " boiling water	19,090
" " Antisana by merc. bar.	19,335
" " " boiling water	18,714
" " Cayambe by merc. bar.	19,200
" " " boiling water	18,600"

Of the glaciers he remarks: "As travelers of eminence have visited and published works upon this region, it is surprising to find that complete ignorance exists respecting its glaciers, yet that there is complete ignorance is evident from the statement made in the recently published article on Ecuador in the 'Encyclopedia Britannica,' in which it says that 'the crater of Altar, surrounded by a steep and jagged wall of rocks, is remarkable as the bed of the only real glacier known to exist in the Ecuadorian Andes.' I found on Altar larger glaciers *out*side the crater than that which was *in*side it; and I found others of large size upon Carihuairazo, Illiniza, Cotocachi, Sincholagua, Quilindaña, Cotopaxi, Cayambe, Sara-urcu, Antisana and Chimborazo."

There is little difference in general features in these equatorial glaciers from those of Europe. The Ecuadorian never descend so low as 12,000 feet, "and they generally terminate between 14,000 and 15,000 feet. Moraines are scarce upon them, for the reason that few rocks rise above them and the evidences which moraines frequently afford of former great extensions of glaciers is consequently wanting. *Roches moutonnées* are rare, more perhaps on account of the ease with which most of the rocks disintegrate than from any other cause. On the south side of Chimborazo, in a valley in which there is now no glacier at all, was the only place in which I was certain of *roches moutonnées*, but this single instance proved that glaciers on that mountain have formerly extended lower down than they do now. It may be stated, as a general rule, that crevasses in the lower parts of the Ecuadorian Andes are both smaller and less numerous than in corresponding situations in the Alps, and this I take to be an indication that in the inferior parts of these glaciers the rate of motion is less rapid than in the Alps. But in the higher regions they are frequently of enormous size, and we never anywhere had seen greater—if indeed so large—crevasses as we encountered on the upper part of Antisana, where some were at least from one-fourth to one-third mile long, 300 feet deep, and 50 to 60 feet across.

"Upon the whole I think that the glaciers are least extensive on the *western* sides of the mountains which have been enumerated, but I speak on this point with some hesitation, as I have not in several cases seen completely around them. It is only what might be expected in a country where vapor-laden easterly wind so largely preponderates. True east wind is, however, rare in comparison with north-east and south-east, which outweigh all the rest. Charged with vapor from the Amazonian cauldron, these winds are almost ceaselessly blowing against the opposing sides of the Great Andes and depositing their moisture in the form of fine snow or hail. In the frequency with which it will be remarked that our ascents were made from the west, there is an illustration of our frequent inability to see anything through the clouds which enveloped the other sides. In *force* the winds were not remarkable."

GEOGRAPHICAL NEWS.—At a recent meeting of the Paris Geographical Society a letter from M. Rabot, now travelling in Norway, was read, which stated that the last two winters, "though very rigorous, have not had any great influence on the opening or closing of the passages because the summers have been remarkably warm. This year, on the other hand, navigation will be stopped very early, as the summer is reported to be a very cold one in the extreme north. M. Broek, formerly a minister of the Norwegian Government, thought there was confirmation of his expectations in the fact that vast numbers of birds, driven out by the rigor of the climate, are now alighting on the shores of Norway. They are arriving in such a state of starvation that they swallow the bait whilst the fishermen are casting their lines." ——Three English gentlemen, Messrs. Delmar Morgan, Peek and Coles, have undertaken an exploration of the east-central and south-east portions of Iceland this summer. They take with them a valuable set of scientific instruments loaned by the Royal Geographical Society.——The *Willem Barents* of the Dutch North Polar Expedition, has not been able to reach Spitzbergen this year. She found the ice extended in a compact mass from 68° 30′ N. lat. and 6° W. long. to 73° 30′ N. lat. and 14° E. long., some twelve geographical miles north of Vardö. There was ice also thirty miles south of Bear Island.——The steamer *Oscar Dickson* was frozen in at the mouth of the Yenisei River in 72° N. lat. and between 76° and 77° E. long. during the last winter. The winter was passed without serious disaster. The sun was below the horizon for seventy days and the cold rose to —41° C. Enormous masses of snow fell during March and April, covering the ice a height of seven feet above the ship's deck. The ice was seven and a half feet thick.——A partial survey was made last year by Commander Boulton, R.N., of the southern portion of Hudson's Straits and the exact position of many headlands and islands ascertained. During August ice formed at night. Between Koksoak River, the extreme point reached, and Cape Chudleigh and thence also to Nachvak Bay [N. lat. 59], Eskimo are the sole inhabitants.——The last number of the Bulletin of the Berlin Geographical Society contains a paper on the Climate of the Glacial Period, by Dr. Woeikoff. For the formation of glaciers a certain amount of moisture in the atmosphere as well as a low temperature is necessary. In the Woznesensky gold mine, at a height of 920 meters, the mean temperature is —90

Celsius, but the climate is rather dry and there are no glaciers. Dr. Woeikoff shows by examples that the difference of mean temperatures at the lower ends of glaciers reaches as much as fully 20°. Provided the quantity of rain and snow is great, glaciers descend as low as 212 meters above the sea-level, as in New Zealand, which has the latitude of Nice and the mean temperature of Vienna and Brussels. He also discusses the decided influence great masses of snow exert upon the temperature of a country.——Dr. Kirk, the English Consul-general at Zanzibar is preparing a work on the tsetse fly.——The Portuguese propose to establish four great stations in Central Africa from which the exploration of the surrounding districts can be carried on.——The missionaries at the University's Mission Station at Masasi, state that the River Lujenda is believed to rise from a great lake east of Nyassa, and it is probable that a good sized lake still remains to be discovered to the north or north-east of Shirwa.——The Italian travelers Dr. P. Matteucci and Lieut. Alfonso Massari reached Liverpool on August 5th, from a journey across Africa. They left Suakin, on the Red Sea, on March 5, 1880, and proceeded by way of Khartum and the province of Kordofan to El Fasher, the capital of Darfur. After wearisome negotiations they were allowed to go to Abeshr, the chief town of Wadai. They then visited Lake Chad, and after traversing Bornu, Baghirmi, Sokoto, &c., they arrived at Egga on June 8, 1881, and reached the Gulf of Guinea shortly afterwards. As the countries passed through are all more or less known, no great discoveries were made, though the travelers were the first Europeans to make the entire journey from the Red Sea to the Atlantic. Dr. Matteucci unfortunately succumbed to disease contracted during the journey, and died, after reaching London, on August 7th.——Mr. Thomson, the African traveler, has arrived at Zanzibar, having been employed by the Sultan to examine the mineralogy of the mainland and also to look for coal which is said to be found near the coast.——The new map of the United States, preparing under the direction of the U. S. Geological Survey, is on a scale of 1 : 250,000.——Dr. O. Finsch, the Polynesian traveler, arrived at Sydney from New Britain early in May last. During his visit of eight months in that island he made large collections, including 12,000 geological specimens. He now visits New Zealand, and goes afterwards to North Australia and thence to New Guinea, making careful observations of the character and habits of the natives of these regions.

MICROSCOPY.[1]

EXAMINATION OF CARBON DIOXIDE IN THE FLUID CAVITIES OF MINERALS.—Mr. Alexis A. Julien thus describes the method employed in his investigations:

"The qualitative identification of carbon dioxide in the cavi-

[1] This department is edited by Dr. R. H. WARD, Troy, N. Y.

ties of a mounted thin section of a mineral, may be determined, at least with probability, after some experience, through various optical appearances and physical characteristics which have been often described. It is usually effected with certainty and ease, through the rapid and enormous expansion and ultimate disappearance, either of the liquid or of the gaseous bubble, on the application of a gentle heat for a few seconds, such as that of a cigar, the heated end of a rod, or jet of hot air, or even a jet of the warm breath conveyed through a flexible rubber tube. When the slide and the thin section are thin, even the heat (37° C.) of the tip of one's finger, applied for a few seconds to the bottom of the slide without removal from the stage of the microscope, may be sufficient to produce the characteristic phenomena, *e. g.*, the contraction and disappearance of a bubble whose size is relatively small to that of the liquid in which it floats.

"For the determination of the temperature of disappearance of the bubble, which may vary from 20° to 32° C., several forms of stage heating apparatus may be employed. * * * In place of all these, a simple and inexpensive apparatus may be substituted, consisting of a miniature water bath in which are immersed the entire section and slide, the bulb of the thermometer, and the nose of the objective. It consists of a box of tinned copper (tinned iron is liable to rust), of length sufficient to project a few centimeters on either side of the stage of the microscope employed; the one I use being twenty-three centimeters in length, 4 centimeters in width, and three centimeters in depth. This is laid across the stage of the microscope, separated from the metal by thin plates of cork, and is heated by a short wax taper (night-light) underneath either extremity. The slide may rest upon the bottom guarded from the metal by little rubber bands beneath the ends, and wedged firmly by a little wooden wedge beneath the horizontal thermometer bulb; or a thermometer with ring-shaped bulb may be inserted, upon which the slide may rest directly, firmly attached by one or two slender rubber bands. The thermometer should be of guaranteed accuracy, with wide degrees, subdivided if possible, with a range which need not much exceed 20 to 32° C. The preparation is then covered by any pure and clear water, preferably filtered (distilled is unnecessary), to a depth of about two centimeters. A circular aperture in the bottom of the box, eighteen millimeters in diameter, is covered with glass attached by cement, and through this the light is thrown up from the mirror. The cavity to be examined is then carefully adjusted and focussed, a taper is lit, and the eye remains at the eye-piece until the critical point is reached. A glass tube with its point terminating just below the edge of the slide, is connected with the mouth during the experiment by a small rubber tube. As the temperature slowly rises, a constant current of small bubbles of the warm breath (whose temperature, 32°, only assists the operation) may be blown up with little fatigue through the tube, to effect a thorough intermixture of unequally heated layers in the water stratum. The determination of the temperature of the disappearance of the bubble is easily obtained within five minutes, and that of its reappearance in about the same time. A low-power objective may be carefully wiped if its anterior lens is dimmed by flying drops or by rising vapor, when a high temperature is being attained; but it is best to insert the whole objective in a small, narrow glass beaker floating upon the surface of the bath over the preparation. * * * In place of the flowing tube a little agitator or churn at the end of the box had been previously tried, to produce the intermixture of the contents of the bath, but was given up on account of the inconvenient vibration and frequent dislodgment of the slide."

A still simpler apparatus was found to be more convenient when high temperatures were not required. In this case a plate of copper or brass 23 centimeters long, 6.5 centimeters wide, and 1 millimeter thick, with a central aperture of 2.5 centimeters, partly wrapped in pasteboard to prevent radiation, was laid upon the stage of the microscope. Over the central aperture was placed a glass tank about six centimeters wide and three centimeters deep, formed of a small chemical beaker with thin bottom and with its upper portion cut off; and in this tank were placed the object, a delicate thermometer and a pointed glass tube, with flexible rubber connection for blowing, held in place by a wire support attached to the metal plate. The section of mineral, mounted on a thin slide, is held in place by rubber bands, or by a small brass weight. Only a single taper is required, and the disappearance of the bubble may be completed in less than five minutes. In summer the temperature of the atmosphere alone may be sufficient, especially if assisted by the current of warm breath, to obliterate the gas bubble. Its return may be readily caused, in a warm atmosphere, by adding, from time to time, a few drops of cool water to the bath, while the eye remains at the eye-piece, and a steady current of air is blown through the glass tube; with this apparatus, which may be called the immersion warm bath, it matters little, for most purposes, what liquid, stand or objective is employed; and there is no difficulty in obtaining, satisfactorily, the two determinations within ten minutes, to an approximation of about one-twentieth of a degree. These forms of apparatus may be of service in other branches of thermal microscopy where an exact determination of the temperature applied is desirable.

Death of Charles A. Spencer.—Those who work with the microscope, or enjoy its teachings, will not soon forget that they have lost a friend in the death of this remarkable man, which occurred at Geneva, N. Y., on the 28th of September. Almost without preliminary education, he undertook the manufacture of microscopes, with little knowledge of the experience of others in the same work, and but little qualification except his individual industry, intelligence and ingenuity. Apprehending the value of aperture as a means of resolution, far in advance of the rest of the world he produced objectives that were not only unequaled, but for a time quite unintelligible. The position so suddenly acquired was worthily occupied; and for nearly half a century Mr. Spencer has maintained a place, by his extraordinary genius for original contrivance and his tact in accomplishing extremely fine work, among the first of the manufacturing opticians in the world. His life was spent at Canastota, N. Y., except the last few years, which were spent at Geneva. From his shop at Canastota he sent out Mr. Tolles, who has since divided the honors with his instructor as a maker of extremely fine and really original microscopical work; and during recent years, as superintendent of the Geneva optical works, while feeble from age and failing health, he has proved so good an organizer and instructor, that his sons have been enabled to produce lenses that would not suffer by comparison with the best work of their father. Among the first and oldest of the original circle of microscopists in this country, and not more skillful as an optician than genial and friendly as a man, he will be greatly missed by his friends, and remembered and honored by all who are interested in his branch of science.

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SCIENTIFIC NEWS.

— The results obtained in the recent deep sea explorations by the Coast Survey steamer *Blake* are of special interest as affording new data for mapping down the floor of the Atlantic. Since May last the *Blake*, under command of Commander Bartlett, reports having run lines of soundings across the Gulf stream from the Florida straits to Cape Hatteras, at the same time making an examination of the great ocean current. The new data obtained show that the Bahama Banks extend in an almost level submarine plateau nearly two hundred miles in width off the Carolinas, and drawing to a point off Cape Hatteras only twenty-five miles off shore, where the depth of water increases to about two thousand fathoms. This revelation of the orography of the Atlantic bottom off our Southern coast is of no little significance. The average depth of water on this long plateau was found by the *Blake* to be but little over four hundred fathoms, and it seems evident, therefore, that it must serve as a vast submarine wall to divert from the Carolina coasts the major part of the glacial undercurrent setting from the Newfoundland Banks to the southwestward. A part of this arctic current, as it moves far beneath the surface, on reaching Cape Hatteras no doubt finds its way between the shore and the prolonged Bahama Bank, even to the Florida coast, but only a small part. The effect of this submarine elevation running almost up to Hatteras, it would seem, is virtually to extend the Gulf stream basin of superheated water up to the North Carolina coast, thus giving the stream much more time after leaving the Florida pass to hold its equatorial temperature unreduced by free commixture with polar water. The Gulf stream is, as Lieutenant Maury said, "the carotid artery of the Atlantic ocean; the great current which connects in their circulation the waters of the arctic seas with the torrid zone," and every investigation which enables the hydrologist more accurately to gauge its thermal power is important.

If the view we have here taken, suggested by the preliminary report of the *Blake's* recent work, is sustained, the agency of the Arctic stream in cooling down the Gulf stream south of Hatteras, which figures as a very considerable factor in Dr. Carpenter's computations of Gulf stream heat, must be regarded as much feebler than it is generally supposed. It is to be hoped that when the details of the late exploration are reduced the results will be fully published. Surveys of this kind are of great value to navigation and science, but they ought to include each summer exact determinations of the temperature of certain sections of the Gulf stream. If we could ascertain every season the temperature, both surface and sub-surface, of this great oceanic artery at fixed points, it would be easy to deduce therefrom the great anomalous changes in the temperature and resultant weather of the northern hemisphere, as General Sabine years ago proposed to do, and thus be in position to forecast the general features of approaching seasons.—*New York Herald.*

— The following process is recommended by Abbass for producing metallic castings of flowers, leaves, insects, etc.:

The object, a dead beetle, for example, is first arranged in a natural position, and the feet are connected with an oval rim of wax. It is then fixed in the center of a paper or wooden box by means of pieces of fine wire, so that it is perfectly free, and thicker wires are run from the sides of the box to the object, which subsequently serve to form air channels in the mould by their removal. A wooden stick, tapering toward the bottom, is placed upon the back of the insect to produce a runner for casting. The box is then filled up with a paste of three parts of plaster of paris and one of brickdust, made up with a solution of alum and sal ammoniac. It is also well first to brush the object with this paste to prevent the formation of air bubbles. After the mould thus formed has set, the object is removed from the interior by first reducing it to ashes. It is therefore dried slowly, and finally heated gradually to a red heat, and then allowed to cool slowly to prevent the formation of flaws or cracks. The ashes are removed by pouring mercury into the cold mould and shaking it thoroughly before pouring it out, and repeating this operation several times. The thicker wires are then drawn out, and the mould needs simply to be thoroughly heated before it is filled with metal in order that the latter may flow into all portions of it. After it has become cold it is softened and carefully broken away from the casting.

— Capt. G. J. Belknap, of the U. S. steamer, *Alaska*, has been taking soundings in the Pacific ocean off Callao bay during a run of 112 miles. At a distance of 102 miles from the shore he found a depth of 3368 fathoms, of nearly four statute miles. That was the deepest depression he could find. The casts brought up clay and greenish sand, the bottom temperature being about 34° Fahr.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Boston Society of Natural History, Oct. 5.—A paper on the species of Orangs, by Mr. F. A. Lucas, was read, and Mr. Burgess described the true mouth structure of the "water-tiger" (Dytiscus).

Academy of Natural Sciences of Philadelphia, March 8, 1881.—Professor Angelo Heilprin delivered the introductory to his course of lectures on invertebrate palæontology. A paper entitled "Structure, affinities and species of Scolopendrella," by John A. Ryder, was presented for publication.

March 15.—Professor Henry Carvill Lewis delivered the introductory to his course of lectures on determinative mineralogy. Mr. Theo. D. Rand called attention to microscopic preparations of minerals. Professor Lewis spoke of a specimen of smoky quartz containing water. Professor Heilprin made some remarks on *Nummulites raymondiopsis* and *Opercularia rotilla*. Mr. Reuben Haines made a communication on impurities in drinking water and the modes of determining them. Remarks on the same subject were made by Messrs. McCook, Heilprin and Morris.

March 22.—Mr. J. A. Ryder gave some of the results of his investigations on the development of the oyster. Dr. G. H. Horn spoke of the larva of a beetle, *Goes pervertulentes*.

April 5.—Professor Angelo Heilprin called attention to special characters in a specimen of Spirifer. Mr. J. A. Ryder made a statement with regard to certain disputed points in the organization of embryo fishes.

April 19.—Dr. Henry C. Chapman gave the results of his dissection of two hippopotami. Mr. Ryder spoke of the development of the nucleus in the ova of fishes and Mollusca. Mr. Tryon read extracts from a letter received from Mr. Hemphill relating to the habits of west coast limpets. Dr. G. A. König called attention to Reinsch's work on the micro-structure of Permian and Triassic coal. The subject was farther discussed by Professor Heilprin. A paper entitled "Observations on Planorbis," by R. E. C. Stearns, was presented for publication.

April 26.—Mr. Ryder spoke of the development of the American four-spined stickleback. A paper entitled "List of the fishes collected by Mr. W. J. Fisher upon the coasts of Lower California, 1876–77, with descriptions of new species," by W. N. Lockington, was presented for publication.

May 3.—Mr. Ryder described the spinning organ of the male stickleback. Dr. G. H. Horn made remarks on the classification of the Carabidæ.

May 10.—Professor H. C. Lewis called attention to a collection of beautiful concretions, and considered the mode of formation. Mr. Tryon read an extract from a letter by Henry Hemphill describing the arrival of a species of Glycimeris from Washington Territory. Mr. Thomas Meehan spoke of the numerical branching of Ampelopsis. Rev. Henry C. McCook made a communication on the spinning work of spiders, its nomenclature and classification.

May 17. — Papers on *Quercus rubra*, *Q. durandii* and *Rhus cotinoides*, by S. B. Buckley, were presented for publication. Professor Heilprin described certain unique specimens of Ammonite and Trigonia. Professor Lewis made further remarks on the concretions presented at a former meeting. Mr. Edw. Potts exhibited a specimen of Stapelia illustrating cleistogamous fertilization.

May 24.—A paper entitled as follows, was presented for publication: "Revision of the Palæocrinoidæ—Part II. Family Sphæroidocrinidæ, including the sub-families Platycrinidæ, Rhodocrinidæ and Actinocrinidæ," by Chas. Wachsmuth and Frank Springer. Mr. Thos. Meehan spoke of the sex of flowers in *Fritillaria atropurpurea*. Dr. Jos. Leidy considered the views of certain European naturalists regarding his genus Ouramœba. Rev. Dr. McCook spoke of the stridulating sound made by ants and how it might be produced. Remarks on the habits of the white ant were made by Drs. Leidy and McCook.

May 31.—The Rev. Dr. McCook read a report of the work done during the season in the department of instruction. A paper entitled "Observation on the Hippopotamus," by Dr. Henry C. Chapman, was presented for publication, the author giving verbally the substance of the communication. Mr. Edw. Potts exhibited a beautiful living specimen of Pyrophorus.

June 14.—A paper entitled "Notes on the Tertiary Geology of the Southern United States," by Angelo Heilprin, was presented for publication. Dr. Horn made some remarks on the entomological work of the late Baron Chaudoir, and then spoke of his, Dr. Horn's, arrangement of the Carabidæ. Mr. Potts defined the genera Heteromeinia and Carterella, and asked for material for illustration of the history of fresh-water sponges. Dr. Anders spoke of his observations on the evaporation of moisture from vegetation, the soil and water.

June 21.—Mr. Meehan spoke of the sudden appearance of modifications in plants, illustrating his remarks by special reference to the presence or absence of the thorns of roses.

July 5.—A paper entitled "The snare of the ray spider, *Epeira radiosa*, a new form of orb-web," by Rev. H. C. McCook, D.D., was presented for publication. Mr. Meehan noted the discovery of *Lilium martagon* for the first time in the United States, and also spoke of the parasitic character of the Rocky mountain snow plant. In continuation he made some remarks on what might be called "floral clock-work," with special reference to the opening and closing of the flowers of *Talinum teretifolium*.

July 19.—A paper entitled "A revision of the Cis-Mississippi Tertiary Pectens of the United States," by Angelo Heilprin, was presented for publication.

July 26.—A note from Edw. Potts was read defining a new species of fresh-water sponge of the genus Carterella.

Aug. 2.—A paper entitled "Remarks on the molluscan genera Hippagus, Verticordia and Pecchiola," by Angelo Heilprin, was presented for publication.

Sept. 13.—Mr. Ryder gave some of the results of his studies of embryo oysters.

Sept. 20.—A paper entitled "Note on the approximate position of the Eocene deposits of Maryland," by Angelo Heilprin, was presented for publication.

Sept. 27.—Mr. Ryder spoke of the anatomy of *Arca pexata*, and also considered Balfour's and His and Rauber's views regarding the growth of embryo fishes.

Oct. 4.—The Rev. Dr. McCook explained how the orb-weaving spiders prepared their webs. Mr. Ryder spoke of a persistent cavity in the germinal disc of fishes, and its connection with the blood-vessel system.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

American Journal of Science, October.—Cause of the arid climate of the western portion of the United States, by C. E. Dutton. Embryonic forms of Trilobites from the Primordial rocks of Troy, N. Y., by S. W. Ford. Thickness of the ice-sheet at any latitude, by W. J. McGee. Marine fauna occupying the outer banks off the southern coast of New England, by A. E. Verrill.

The Geological Magazine, September.—The cause of the Mammoth's extinction, by H. H. Howorth. Absence of joint-structure at great depths, by W. O. Crosby.

Zeitschrift für wissenschaftliche Zoologie, August 19.—Locomotion and organ of locomotion of *Cyclostoma elegans*, and of other native snails, by H. Simroth. On the developmental history of the skull of Anura, by Ph. Stohr. The division of monothalomous Rhizopods, by A. Graber. On the development of *Neretina fluviatilis*, by F. Blochmann. On the allantois of man, by W. Krause.

PLATE II

ESSEQUIBO INDIAN HUT

THE

AMERICAN NATURALIST.

VOL. XV. — *DECEMBER*, 1881. — NO. 12.

DEMERARA.

BY F. M. ENDLICH.

THAT northern portion of South America, known as Guyana, Gyana or Guiana, has been, in the course of time, separated into several provinces, one of which fell to Great Britain. British Guiana, or Demerara, was ceded to the Crown by Holland in 1814, and since then has been one of England's important colonies. Located within the equatorial zone, the country affords no inducements for extensive white settlement; only those who are accustomed to such climate can be employed in the prosecution of various industries and enterprises. European civilization and energy have wrested from the fertile soil golden fruits, and the flourishing colony has seen a long period of uninterrupted prosperity.

While the country bordering upon the sea is low and flat, it becomes more broken and even mountainous towards the interior. Complete explorations of the southerly portions of the colony have not been made as yet, and, in consequence, strange legends and rumors are afloat concerning the hidden mysteries and well-guarded treasures of the *terra incognita*. Gold is reported to have been found at various places, sometimes as nuggets and again imbedded in the rock. Traditions of unsurpassed mountain scenery, the Alps and the equator combined, tempt the spirit of venturesome travelers. Within accessible distance, the Kaiteur falls, renowned for their picturesqueness, have received the homage due them, at the hands of those who braved alike climate and fatigue to enjoy their refreshing thunder.

Dense, tangled "bush," the frequency of swamps and marshes, both abounding in creatures of decidedly anti-domestic tendencies, render exploration difficult, and turn even a so-called pleasure trip into arduous labor. So far as plantations and isolated settlements extend, transportation is a matter of no difficulty, even steam being employed for the convenience of passengers and freight. Beyond these limits, however, only great endurance and immunity from climatal influences, will enable the stranger to satisfy his thirst for knowledge of a region but little known to the civilized world.

Almost involuntarily the comparison obtrudes itself between exploration in arctic and tropical regions. On the one hand a temperature which would seem to congeal every impulse, benumb every physical and mental capacity; on the other, a degree of heat which renders alike exercise and rest a matter of positive danger, and produces conditions of mental indolence and apathy similar to the first. Passing over rugged, broken fields of ice and snow, where every individual force is brought into requisition, may be compared to the struggle through densely matted forests, through treacherous marshes,

> "Where at each step the stranger fears to wake
> The rattling terrors of the vengeful snake."

Unequal, however, would seem the reward. While atmospheric phenomena alone beautify the field of the arctic explorer, while to him the midnight sun is but a weird shadow of the day he longs for, and while the fitful gleams of an aurora bring to mind the indestructible forces of nature, every step in the tropical country, unless it be a desert, calls forth admiration and wonder at the vigor and fullness of animal and vegetable life. Forms of the most profound interest rise up before him, forms of which he finds but the stony record of bygone eras in his own country. The marvelous vitality of plant life, too, affords him a glimpse into the sealed book of geological age, where time appears to be annihilated.

Approaching by sea from the northward, a dark line along the horizon denotes the presence of land. As the water is shallow in the vicinity of the coast, all ships of heavy draught are obliged to wait for high tide before entering the harbor of Georgetown, Demerara's capital. A chapter on the gradual accretion of land, and on the hydrographic conditions of the northern coast of South America, would here be out of place, so it may suffice to remark that the coastline of British Guiana is subject to serious changes in consequence of marine currents, unless such changes be anticipated and avoided by artificial means. In order to protect plantations and settlements of the lowlands, the Dutch Government caused an extensive "sea-wall" to be built. The experience gained by them in their native country was here successfully applied, and the profits accruing from this tremendous undertaking have shown the wisdom of its inception. Repairs to this means of defense require annually large sums, which are borne by estate owners and the British Government, in order to secure cultivation and returns from lands which otherwise would be submerged at high tide.

Georgetown is certainly a most beautiful place. As the center of enterprise, from which is directed the utilization of resources afforded by the colony, it has a busy appearance. Immediately beyond the business quarters of the town, however, are the delightful habitations and luxuriant gardens of its citizens. A welcome sight is that of the Stars and Stripes, floating over the residence of our consular representative, Col. Figyelmesy; his courteous thoughtfulness and hearty reception will ever render the visit to his tropical home a most grateful memory.

The construction of houses, which permits free circulation of air, is thoroughly well adapted to the exigencies of the climate. A sea-breeze keeps the air in motion and makes life very endurable. No pen can do justice to the brilliancy of the tastefully arranged gardens by which nearly every house is surrounded. Magnificent flowering trees, and shrubs exhaling fragrant perfumes, are cultivated in abundance. Hospitality is a leading feature of the citizens, and the stranger finds every opportunity offered him for admiring their sense of the beautiful.

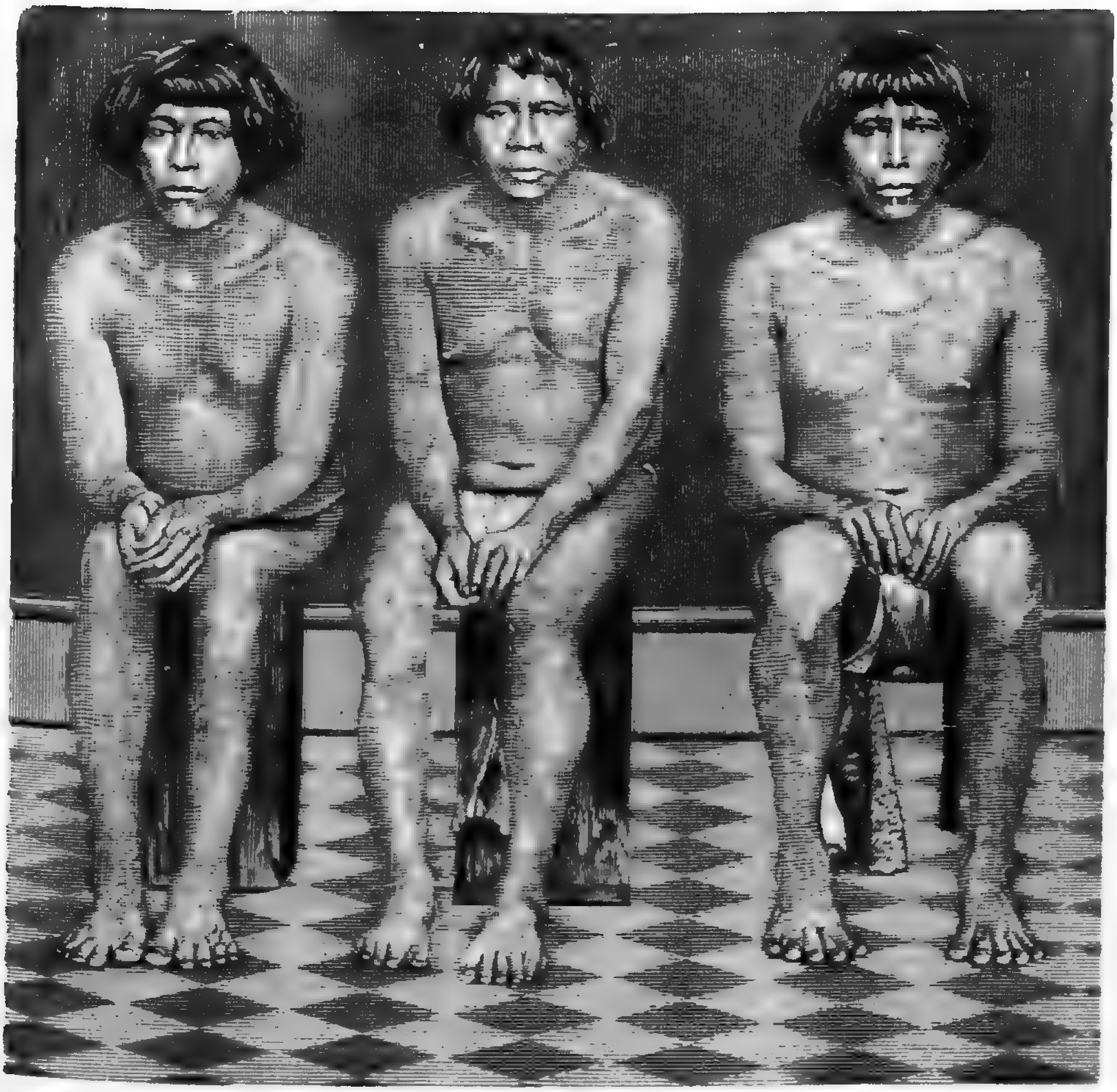
In our northern climes, where nearly one-half of the year seems devoted to the apparent dying and death of all plant life, we are driven to bestow an adequate portion of our affections upon more unchangeable objects. Thus it is hardly surprising that blue-colored plates, hideous ornaments of days gone by, and chairs, quaint to look at, but also quaint to sit upon, claims so much of our attention. When climatal changes interrupt the enjoyment of nature's exhibits, it seems necessary to find other subjects upon which the superfluous sentimentality demanded by reigning fashion can be expended.

It would require the eyes of Argus to take in all the floral beauty, and at the same time do justice to the picturesque appearance of the streets. Famous for its arrangement and the care bestowed upon it, is the public garden of Georgetown, and it can readily be imagined how flourishing any undertaking of this kind must be, in a climate so propitious to the highest and most speedy development of vegetable life.

While the commerce of the colony is largely in the hands of Englishmen, a goodly number of Portuguese have acquired prominence in the mechanical and domestic arts. Negroes, Indians, Chinese and East Indians, all of them, more or less—generally less—fantastically attired, mingle with the bright colored uniforms of British soldiery. On market days, the scene is one of great interest. Large trees shelter the space devoted to this purpose, and beneath them, may be seen stretched the dusky forms of Africans, Americans and Asiatics, in peaceful contemplation. Groups of chattering coolies, of more silent Indians, and of exhilarated darkies are scattered everywhere. Shouts and cries, partly of recognition, partly to attract customers, are heard on every side. Fruits and other produce, as well as articles prepared by the skillful hands of natives, are exposed for sale.

Passing along we may meet a bronze-colored girl, clad in a short petticoat, boddice and breast cloth of flaring hues, gold and silver armlets, wristbands and anklets, which worn in profusion, show a pleasing contrast to the soft, dusky skin. Hair, black as jet, falls from under a head-gear composed of a single cloth, which is draped with inimitable grace and ornamented with gold and silver spangles and rings. Dark, piercing eyes are deeply set beneath finely developed eyebrows. The flattened, somewhat broad nose is supplied with a curiously fashioned button, fastened into its side. Earrings of liberal proportions and sometimes elaborate workmanship adorn the members for which they are intended. Small hands and feet denote purity of race, and the girl proves to be one of the imported East Indian coolies. Her entire wealth consists in the trinkets with which she bedecks her person, and the consciousness of her superior charms is visible in every movement. From a dark olive tint, the color of these coolies varies to almost black, particularly among the males. Of medium height, thin, but very muscular, their bodies and limbs exposed by a minimum of clothing, these people present a striking type, adding

PLATE I.



ESEQUIBO INDIANS.

greatly to the fantastic character of the scene. Upon occasions of more elaborate toilet, they drape themselves in a burnous-like cloak of white or striped material, and wear turbans. Long staffs of Yakka-wood, hard and tough, serve manifold purposes. They assist in the carrying of burdens and give employment to hands and arms. It is stated that during one of the more recent insurrections the laborers did terrible execution with these Yakka sticks.

The native Indians have adapted their costumes to the requirements of the climate. While selling their produce, they walk the streets in a costume that would create consternation in the drawing-room. Negroes have found the place allotted to them throughout the world, although a few have shown an enterprising spirit, and consequently have risen in wealth and importance.

Chinamen follow the calling which elsewhere serves to make them conspicuous. Their intimate relation to soap and washboards proves them to be a very useful factor in social economy, wherever they go. At Georgetown, a special quarter is assigned to them, and they live as though sheltered by their own native country. Stores, kept by Chinamen, supply them with food and utensils from the celestial empire, and they worship their own particular deities with the same regularity and observances as at home. Frugal habits and the never-dying desire to spend the last days of their lives in the land of their ancestors, impel them to labor earnestly for the pittance, which, for their wants, constitutes a fortune. As workmen on sugar estates they are highly prized. Their sagacity and industry make them indispensable to their owners.

Leaving Georgetown by rail, the route lies through low marshy country; a large portion of this would be flooded at high tide were it not for the protecting sea-wall. Advantage has been taken of this fact, and narrow canals, connected with the bay, supply the place of roads on plantations. The first glance discloses the main staple of the colony, sugar-cane. Extensive works are visible in many directions, and immense fields are covered with the growing cane. Demerara sugar production has kept pace with the improvements devoted to the industry. Visiting an estate of perhaps several thousand acres, the traveler finds himself within a small, well regulated commonwealth.

Coolies, negroes and Chinamen, perform the labor. Dozens of working-men and women may be seen cutting the cane, and transferring it to iron punts on the small canals. By way of the latter, the sugar-house is reached and the extraction of cane-juice begins. Machinery of ponderous dimensions, is employed to crush the cane, and the juice resulting therefrom undergoes the usual process of boiling. Evaporation of moisture at the right time is an important item in the manufacture of sugar, and much ingenuity as well as money has been expended in producing the most satisfactory appliances for this purpose. Without entering into details it may be stated that the sugars of Demerara are prepared under exceptionally favorable auspices. Excellent workmen, carefully trained by their superiors, the supervision of expert chemists, and the deep interest taken by all in the production of this staple, ensure an article which need rank second to none.

The interior of a sugar-house shows a motley assemblage: negroes and coolies chanting their monotonous song, attend to the feeding of the crusher. Dark figures almost naked, flit through the clouds of steam rising from the boiling pans. What with the noise from machinery, the weird half-light and the impish looking creatures stirring the boiling masses, a vision of the *Inferno* is readily suggested.

For this colonial industry the influx of East Indian coolies has proved a blessing. The matter has received due attention from the British Government, and the immigration of these people, as well as their subsequent stay is admirably managed. Estate owners are obliged to provide them with suitable habitations and the necessaries of life, besides paying stipulated wages. Hospitals are established on the premises, and resident physicians have charge of patients. In every way the workmen and their families are satisfactorily cared for. Often they even prefer to remain after the five years of their contracted time have expired. Should any occasion for complaint arise, there is at hand a special bureau created for this purpose, and causes of abuse are removed with rigorous justice. Upon departure from the scene of his servitude the coolie has guaranteed to him the passage to his own home, and the few hundreds of dollars which he has saved by economizing, enable him to live in comparative comfort and ease among his countrymen.

A coolie village is an attractive sight. Trim huts, placed within small gardens, stand in rows along the road. Numerous children, often elaborately clad in only a bead necklace, play around the street and garden. Old men and women seek the shade and enjoy their smoke, while the younger ones are at work in the fields or in the sugar-house. Certain clans seem to band together, indicating their character by hanging out a flag, and to all appearances the people are happy. On gala-days, or when a visit is made to the town, all available ornaments are brought into requisition for personal adornment, and great is the pride of their wearers.

Beyond the estates are found tracts of "bush." Difficult of access on account of intervening swamps, these remnants of original forest present an almost impenetrable front. Densely intertwined plants, one clinging to the other in emulation of the traditional ivy and oak, form an effective barrier, and nothing but a long *machete* will be of any avail in traversing

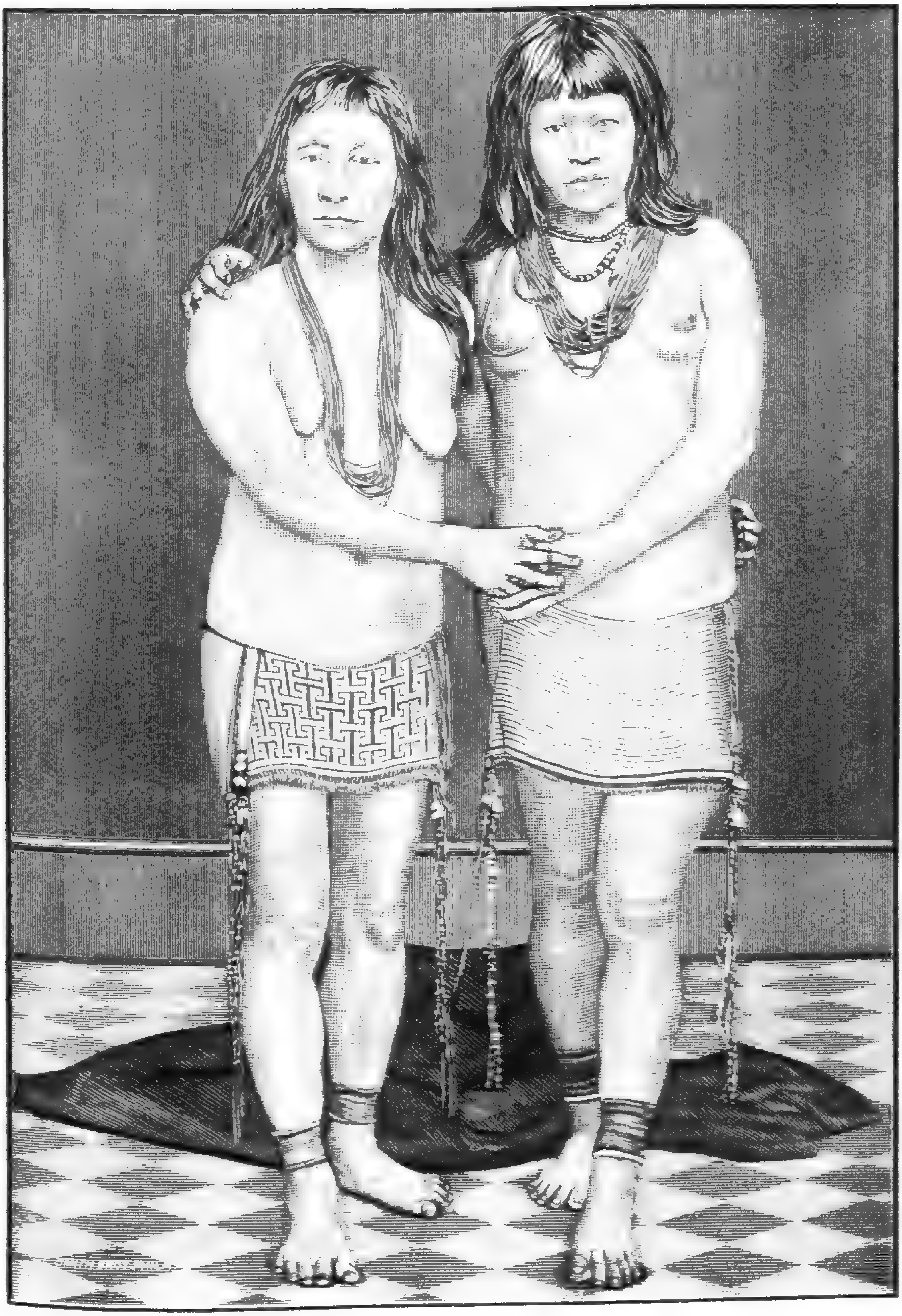
> "Those matted woods, where birds begin to sing."

Occasional swampy clearings harbor flocks of white herons and other birds.

Living along the Esequibo river and its tributaries, we encounter the native Indians (Plate I). They are separated into tribes, bearing similar relations to each other as of our own Indians. Here they follow hunting and fishing, basket making, the production of pottery and netting of grass hammocks. For shelter they build rude huts, generally protected on one side by trees and other growing plants, while three sides are open. Thatched palm leaves form the roof, which protects the inmates from heavy dews and periodical rains. Hammocks of twisted grass are swung between the poles which support the roof, and serve as resting places by day and night (Plate II). An Indian nature requires much rest. These hammocks have acquired a well merited reputation and are prized on account of their lightness and durability. Physically the Indians present a strong, healthy appearance. They are of medium height, well knit, muscular, and rarely show any superfluous tissue. Thick black hair covers their heads and protects them from the rays of a tropical sun. Sometimes this is worn long, falling over the shoulders. Square, massive features characterize the face, which would have a stupid expression were it not for the bright, black eyes. The men wear few or no ornaments, and usually no clothing except a loin-cloth. Generally the women are well developed, muscular, and appear more agile than the men. Both are able to endure great bodily hardships. Necklaces made of beads, teeth, feathers, the lustrous wings of bugs and other materials of personal decoration in use among savages, are the never-failing adornments of these squaws, although all other wearing apparel may be dispensed with. Short aprons, worked in attractive patterns and trimmed with beads and feathers, are worn. Long tassels, interwoven with fur, feathers and grass are attached thereto. Anklets, either of metal or plaited grasses are almost invariably used, and appear to answer, in some way, the purpose of protecting and strengthening the lower portion of the leg (Plate III). The female Indian is not beautiful, far from it, but in appearance she compares favorably with our North American squaw. As usual the women perform the greater portion of the manual labor, although the "lords of creation" will sometimes condescend to assist. Hunting, fishing, the search for valuable timber or medicinal plants, with an ample allowance of peaceful repose, fully occupy the man's time. Rum, obtained at a ridiculously low price, furnishes restful oblivion and freedom from care. This, together with tobacco, serves to smooth the native's path and gently hurry him along on his journey through mundane scenes.

Spears and arrows are used in fishing. Generally the spear-heads are three-pronged and sharply barbed, but for smaller fish one prong suffices. Often these are made of a poisonous wood, which is said to paralyze the motions of the animal, so that it may easily be taken. Long arrows with iron points are shot into the fish, which then are speedily secured. Fishing, by hook and line, or net, provides a large portion of the Indians with bodily sustenance. Quadrupeds, birds and snakes are likewise hunted with spear and arrow. The former is a sort of javelin with poisoned tips. For long distances a bow is used measuring nearly seven feet in length, arrows in proportion. Beautiful workmanship and taste in decoration make these weapons very conspicuous. Bird-arrows and those destined for larger game are prepared with special reference to the distances of their flight and the animals they are aimed at. For hunting in the bush a short bow, about three or four feet long, is employed. An ingenious contrivance saves the hunter from losing his arrows in case the game be only wounded; at the same time it enables him to do a great deal of execution with only a small supply of weapons. For this pur-

PLATE III.



Esequibo Indians.

pose the point-end of the arrow is made blunt, and a narrow longitudinal slit cut into one side. The end is tightly wound with cord made of wood fiber. A number of points about the size of matches are cut from the siliceous rind of reeds and are prepared with ourare. Inserting one of these points into the slit, it is held there firmly enough to enter the body of an animal, while the arrow drops off and can be recovered.

Ourare is a very important factor in the hunting equipment of Guiana Indians. It is prepared by them from a variety of poisonous woods, barks and fruits, is placed in small calabashes and carefully wrapped in leaves. When required for use, cassava juice is employed to soften it. The deadly effect of this poison is too well known to require further mention. Inasmuch as it is used not only for purposes of the chase, but also in warfare, the Indians have recourse to what they claim as an effective antidote. In appearance this is a black powder, resembling charcoal. Any person desiring to make himself ourare proof, inoculates himself at several places of his body. By taking this precaution he is supposed to be insured against the deadly action of the poison for a number of years. In case no previous inoculation has taken place, an immediate introduction of this substance into the blood is said to neutralize the effect of ourare.[1]

Apart from the more warlike propensities of the chase, the Guiana Indians are no strangers to the soothing influences; they have invented flutes to beguile the hours when not resting. Two kinds are especially noticeable, the one made of reeds, the other of suitable bones. Of the latter the leopard furnishes the most frequent specimens. Whether it is merely a matter of preference or whether the possession of such a flute recalls reminiscences of successful encounters, cannot be told. Limited as to scope and volume, yet the sounds produced by these instruments, ornamented as they are with bright feathers and tassels, show that

"* * * music for the time doth change his nature."

In their domestic relations the Demerara Indians resemble their North American brethren. Contact with the whites has had the same influence upon them. Living in a zone where clothing can be dispensed with, where the sustenance of life is rendered easy by

[1] I have been assured by a gentleman that this was a fact, he having seen the experiment of ourare poisoning and the administering of the antidote, successfully performed upon dogs.

the bountiful provision of nature, they have but few wants. Rum, beads, and trinkets comprise their ambition. In exchange for these they furnish rude pottery, handsomely wrought baskets and the hammocks above mentioned. Farther towards the interior these people have hardly been disturbed as yet, and live on without being affected by extraneous influences. Their haunts are difficult of access, and it is but rarely that any venturesome traveler penetrates to their homes.

Traveling by water is perhaps the most available method, but even then many obstacles confront the explorer. It is owing to these facts that comparatively little is known of the Guiana Indians, and it may be a long time before complete information can be obtained regarding their distribution, manners and customs. A praiseworthy spirit has been shown at Georgetown, by the establishment of a Colonial Museum, where archæological specimens and products of the present day are carefully preserved. The great interest taken at this time in matters pertaining to ethnology and anthropology has pervaded all countries and all classes, so that we may hope ere long to see the correlations of races and tribes, now obscure, more fully established.

The tropical flora and tropical fauna are too well known to require any special mention. The rich, strong colors, the evidence of exuberant life and the unaccustomed forms exhibited by the vegetation must make a profound impression upon the stranger from northern climes. Where every step, every turn reveals so much that elicits sympathetic response, it is natural that the admiration of nature's most lovely products should become an integral part of the appreciative mind.

Demerara has made great strides in development during the past few decades. Sanitary measures, well adapted regulations as to non-European inhabitants, and good government have brought the colony to a condition of flourishing welfare. The comforts of home-life have been combined with the advantages of tropical residence, and few places, indeed, may be visited, which will so amply repay the trouble. Staples for which there is constant demand are the basis of colonial wealth, and the enterprise heretofore shown by planters and manufacturers, gives assurance that in its own productions Demerara will never be found lagging behind its competitors.

A SKETCH OF THE PROGRESS OF BOTANY IN THE UNITED STATES IN 1880.

BY PROFESSOR C. E. BESSEY.

A. Anatomy and Physiology. — A valuable paper appeared in the *Botanical Gazette* for November, on "The Stem of the Pumpkin for illustrating Plant Histology," by J. C. Arthur. The disposition of the various tissues, with notes upon some of their peculiarities, and suggestions as to the best methods of preparing them for observation, make up the bulk of the paper. Finally a classified list of the tissues is given, as follows:

Epidermal System:
- Epidermis.
- Stomata.
- Hairs.

Fundamental System:
- Interfascicular parenchyma.
- Hypoderma;
  - Cortical wood.
  - Cortical parenchyma.
  - Collenchyma.

Fibro-vascular System:
- (Cambium.)
- Phloëm;
  - Sieve-tubes.
  - Phloëm parenchyma.
- Xylem;
  - Vessels;
    - Annular.
    - Spiral.
    - Reticulated.
    - Scalariform.
    - Pitted.
  - Wood parenchyma.

"To these should doubtless be added Laticiferous tissue, sometimes detected in the phloëm."

W. K. Higley, in two papers published in the NATURALIST for Oct. and Nov., added somewhat to our knowledge of the "Microscopic Crystals contained in Plants." Many crystal-containing plants are noted, and a useful list is given of all the natural orders of plants in which these structures have been observed.

Dr. Engelmann's paper on "The Acorns and their Germination," published in the Transactions of the St. Louis Academy of Sciences, Vol. IV, records the results of his careful study of the germination of the acorns of many species. In addition to a definite statement of the structure of the embryo in the species examined, the author describes the tuber-like enlargement of the radicle in the live-oak, caused by the transfer to the latter of the food from the cotyledons.

In a paper on "The Supposed Dimorphism of *Lithospermum longiflorum*," by C. E. Bessey, published in the June number of the NATURALIST, the writer showed by means of many measurements that this species is not dimorphic (heterostylous), but that its large flowers are exceedingly variable as to length of corolla and style.

Thomas Meehan's "Dimorphic Flowers in Houstonia" and "Cleistogamy in *Oxalis acetosella*," and I. C. Martindale's "Sexual Variation in *Castanea Americana*," published in the Proceedings of the Academy of Natural Sciences of Philadelphia, should be noted here as interesting contributions to this department of botany. The "Notes on the Flowering of *Saxifraga sarmentosa*," by Professor J. E. Todd, in the August NATURALIST, are somewhat more extended than the preceding, and accompanied by several wood-cuts.

"Nectar and its Uses," published by Wm. Trelease in the Report upon Cotton Insects, issued by the Department of Agriculture, is a carefully prepared essay, bringing together what is known as to the production and uses of the nectar of plants. A plate and an excellent list of the books and papers treating of nectar, add to the usefulness of the essay.

Professor W. J. Beal published in the March number of the NATURALIST, some notes on the "Agency of Insects in Fertilization." These notes were made by students under the guidance of the professor, and many of them are admirable.

Wm. Barbeck, in the Proceedings of the Academy of Natural Sciences of Philadelphia, published a paper on "The Development of Lemna," in which he concludes that in Lemna "we have an interesting instance of parthenogenesis, there being seeds (produced in autumn by a sexual process) from which, during the course of the summer, generation after generation is propagated without any further fertilization."

Here should be mentioned Dr. Gray's note on the "Automatic Movement of the Frond of *Asplenium trichomanes*," published in the *Botanical Gazette* for March, and W. K. Higley's notes on "Carnivorous Plants" (*Drosera rotundifolia*) in the December number of the same journal.

B. Systematic Botany.—a. Fungi. In the March number of the *Botanical Gazette*, C. H. Peck described nineteen new species of fungi, mostly from the Eastern United States. These are an interesting Stemonitis (*S. Morgani*) which is closely related to *S. fusca*; *Coniothyrium minutulum*, *Leptothyrium chromospermum*, *Phoma albistrata*, *Phoma colorata*, *Septoria consocia*, *Septoria irregulare*, *Discella variabilis*, *Sporidesmium minutissimum*, *Lecythea* *macrosora*, *Æcidium Jamesianum*, *Sorosporium atrum* on a Carex, from Pennsylvania and Colorado, *Cheiromyces tinctus*, *Peziza spongiosa*, *Phacidium sparsum*, *Stictis fulva*, *Diatrype angulare*, *Sphæria altipeta*, *Sphæria lichenolis*.

Twenty-nine new species of fungi, collected in California by Dr. Harkness, were described by M. C. Cooke in the September number of *Grevillea*. The descriptions are mere Latin diagnoses, and are by no means satisfactory. The species described are *Phoma hosackiæ*, *Chætophoma atriella*, *Vermicularia subglabra*, *Septoria helianthicola*, *Discella olivacea*, *D. tenuispora*, *Diplodia microscopica*, *D. rhuina*, *Hendersonia galiorum*, *Dichomera phaceliæ*, *D. compositarum*, *Glœosporium leguminis*, *Torula glutinosa*, *Coleosporium baccharidis*, *Macrosporum culmorum*, *Trichaëgum atrum* Preuss., *T. opacum*, *Fusarium gallinaceum*, *Leotia ochroleuca*, *Stictis decipiens* Karst., *S. radiata*, var. *pumila*, *S. annulata* C. and Phil., *Ascomyces fulgens*, *Sphæria labiatarum*, *S. epipteridis*, *Sphærella brachytheca*, *S. araliæ*, *S. dendromeconis*, *S. acaciæ*. All, with three exceptions indicated above, are described as by Cooke and Harkness, who are therefore to be quoted as the joint authors of the specific names.

M. C. Cooke enumerated thirty-one species of "New York Fungi," of which seven were new, in the March number of *Grevillea*. The new species which are described are the following: *Coniothyrium rubellum*, *Diplodia celastri*, *D. compressa*, *Massaria Gerardi*, *Psilosphæria melasperma*, *Conisphæria peniophora*, *Sphærella ilicella*.

Two new species of Septoria were described by Baron F. De Theumen in the October *Botanical Gazette*, one (*S. Albaniensis*) on Salix from New York, and the other (*S. Querceti*) on Quercus from South Carolina.

An interesting addition to the Phalloidei was made in an article on "A New Fungus," by W. R. Gerard, in the January *Bulletin of the Torrey Botanical Club*. The new species, *Simblum rubescens*, was discovered on Long Island. A full and satisfactory description is given, and two good plates are added. Appended to the paper is a valuable "List of United States Phalloidei," including all "which have been detected in the United States up to the present time."

The "Catalogue of Pacific Coast Fungi," by Dr. Harkness and J. P. Moore, first read before the California Academy of Sciences, Feb. 2, 1880, and afterwards published in a pamphlet of forty-six pages, enumerates nearly 900 species. Localities and habitat are given for the greater number of the species. One new species, *Agaricus tridens* Moore, from a drift 400 feet below the surface, is described.

A valuable article on "The White-grub Fungus," appeared in the June number of the *American Entomologist.* The writer (C. V. Riley) appended a list of papers containing references (mostly popular) to this fungus. Two wood-cuts accompany the article.

Professor Prentiss' paper in the August and September NATURALIST, on the "Destruction of Obnoxious Insects by means of Fungoid Growths," recorded the results of a series of experiments with yeast as an insecticide. The results were plainly adverse.

Professor Burrill's paper on "Anthrax of Fruit-trees," read before the Boston meeting of the American Association for the Advancement of Science, did not reach the public, through the tardy publication of the "Proceedings," until about a year later. Abstracts appeared in various journals, one of which, viz., that in the *American Monthly Microscopical Journal*, is selected for notice here. The disease called blight is held, by Professor Burrill, to be due to "a living organism which produces butyric fermentation of the material stored in the cells, especially those in the liber. This organism is allied to, if not identical with the butyric vibrione of Pasteur, and the *Bacillus amylobacter* of Van Tieghem." Experiments were made by inoculating healthy trees, and the results appeared to sustain the theory of the bacterial nature of the disease. The bacteria observed were described, and careful measurements given.

Century IV of Ellis' now well-known "North American Fungi," was issued during the year.

b. Algæ. Francis Wolle's paper on "Fresh-water Algæ," in the April *Bulletin of the Torrey Botanical Club*, contained a "list of upwards of one hundred plants, at least ninety of which are new to the United States, and of which eighteen were wholly unknown." The new species described are the following: *Sphærozyga saccaia, Tolypothrix bombycina, Euastrum Donnelli, E. formosum, Micrasterias Kitchelli, Staurastrum pulchrum, St. Nova-Cæsareæ, St. tricornutum, St. macrocerum, St. fasciculoides, St. subarcuatum, St. comptum, St. pusillum, Arthrodesmus fragilis, Pleurocarpus tenuis, Œdogonium Donnelli.* In the August number of the same journal the same author publishes a plate containing good figures of all the new desmids in the preceding list.

Dr. Farlow's paper "On some Impurities of Drinking-water caused by Vegetable Growths," published in the First Annual Report of the Massachusetts State Board of Health, contributed to our knowledge of the economic relations of the fresh-water algæ to ourselves. Two plates accompany this valuable paper.

Dr. T. F. Allen's "Characeæ Americanæ Exsiccatæ," consisting of dried specimens of ten species of Characeæ, was issued late in the year. The species are *Nitella tenuissima* Desv., *N. intermedia* Nordst., *N. megacarpa* Allen, *Chara intermedia* A. Br., *Ch. intermedia* A. Br., var. *Americana* A. Br., *Ch. contraria* A. Br., *Ch. sejuncta*, A. Br., *Ch. coronata* A. Br., var. *Schweinitzii* A. Br., *Ch. gymnopus* A. Br., var. *Michauxii* A. Br., *Ch. hydropitys* A. Br., var. *septentrionalis*, Nordst.

c. Lichenes. Our lichenologists appear to have published nothing during the year.

d. Bryophytes. A severely critical paper entitled "Bryological Notes and Criticisms," by the lamented Coe F. Austin, appeared in the January *Bulletin of the Torrey Botanical Club.* It was suggested by the study of a paper by Lesquereux, James and Schimper containing descriptions of new species of North American Mosses. Mr. Austin challenged many of the new species described in the paper under review.

Mr. Austin published a paper, Bryological Notes, in the February number of the *Bulletin*, consisting of critical notes upon several species of mosses and several descriptions. The new genera Donnellia and Rauia were announced (but not described) and descriptions were given of *Donnellia Floridana* and *Thuidium Alleni.*

The "Catalogue of North American Musci," by E. A. Rau and A. B. Hervey, enumerates 1237 species. Localities are given for all the species.

e. Pteridophytes. Professor D. C. Eaton's magnificent work, "The Ferns of North America," was brought to a close early in the year. The beautiful plates, by Emerton and Faxon, and the clear and satisfactory descriptions are notable features in this great contribution to our knowledge of the ferns of this country.

In the June *Bulletin of the Torrey Botanical Club*, Professor Eaton, under the title of "New or Little-known Ferns of the United

States," notices several species, and describes one new one, *Notholæna Lemmoni,* from Arizona. The same author's "Systematic Fern List," a twelve page pamphlet, appeared in September. It consists of "a classified list of the known ferns of the United States of America, with the geographical range of the species." One hundred and fifty-one species and sixteen varieties are included.

In "A New Fern," by G. E. Davenport, in the *Bulletin of the Torrey Botanical Club*, the author describes a new species (*Notholæna Grayi*) from Southeastern Arizona. A fine plate by Faxon accompanies the paper.

f. Phanerogams. Dr. Gray's "Contributions to North American Botany," published in the Proceedings of the American Academy of Arts and Sciences, Vol. XVI, is principally devoted to "Notes on some Compositæ." Synopses of species are given for the genera Aphanostephus, Chætopappa, Townsendia and Erigeron, and important notes are included under Vernonia, Solidago and Aster. Two new genera, Greenella and Grundlachia, and a number of species are described. Six new species of Asclepias are noted, and a new genus (Geniostemon) with two species of Gentianaceæ are described. Descriptions of miscellaneous species, and of a new genus of Euphorbiaceæ (Reverchonia) complete this valuable contribution.

Dr. Gray also published a synopsis of the species of the genus Leavenworthia, in the March *Botanical Gazette.*

A most important paper from Dr. Geo. Engelmann, entitled a "Revision of the genus Pinus, and Description of *Pinus Elliottii,*" was published in the Transactions of the Academy of Sciences of St. Louis, Vol. IV. The characters of pines are carefully described *in extenso,* and upon these a new arrangement of the species is proposed. The characters of the fruit scale serve to separate the genus into two sections, viz: I. Strobus ("Apophysis with a marginal unarmed umbo, generally thinner"), and II. Pinaster ("Apophysis with a dorsal umbo, mostly armed, generally thicker"). "The subsections are distinguished by the position of the ducts within the leaf." The description of *Pinus Elliottii,* a south-eastern species, is all that could be desired, and this is supplemented by three large and most excellent plates.

In the January *Botanical Gazette,* Dr. Engelmann described, in full, the northern Catalpa, *Catalpa speciosa,* which had previously been considered to be *C. bignonioides.*

Several new species of the genus Potamogeton were described by Thomas Morong, in the May *Botanical Gazette.* The new species are *P. Illinoensis*, *P. Mysticus*, *P. lateralis*, and *P. gemmiparus* (the latter by Robbins). Notes are added upon several other species.

I. C. Martindale, in a pamphlet entitled "Notes on the Bartram Oak, *Quercus heterophylla* Michx." reviewed the whole history of this much discussed and doubted species, and concluded that it should be restored as a true species.

Professor Sargent's "Preliminary Catalogue of the Forest Trees of North America," contained 342 species, with notes as to size, range, economic uses, etc.

Mention should be made here of H. W. Patterson's "Check List of N. A. Gamopetalæ after Compositæ," designed for use in making exchanges, marking desiderata, etc.

Robinson's "Flora of Essex county, Massachusetts," Smith and Mohr's "Preliminary List of the Plants growing without cultivation in Alabama," Peck's "Plants of the Summit of Mt. Marcy" (from the 7th Rept. of the Adirondack Survey), the list of "Ballast Plants in and near New York city," by Addison Brown, in the December *Bulletin of the Torrey Botanical Club*, are valuable additions to our knowledge of local floras. Here may be noted the beginning, in the last named journal, of an important List of the State and local floras of the United States, by W. R. Gerard and N. L. Britton.

C. Geographical and Geological.—Dr. T. F. Allen, in a paper entitled "Similarity between the Characeæ of America and Asia," in the *Bulletin of the Torrey Botanical Club*, pointed out the resemblance between the Asiatic and American Characeæ. "A Summer in Roan mountain," by J. W. Chickering in the December *Botanical Gazette*; "A Botanist in Southern California," by J. F. James, in the July NATURALIST; "Botanizing on the Colorado desert," by E. L. Greene, in the November NATURALIST; "The Timber Line of High Mountains," by Thomas Meehan, in the Proceedings of the Academy of Natural Sciences of Philadelphia, and "The Geological History of the North American Flora," by Professor Newbury, in the July *Bulletin of the Torrey Botanical Club* (abstract of a lecture) are the other important contributions under this section.

D. Historical.—The conclusion of Frederick Brendel's "Historical Sketch of the Science of Botany in North America, from 1840 to 1858," in the January NATURALIST, and the "Sketch of the Progress of Botany in the United States in the year 1879," by C. E. Bessey, in the December NATURALIST, are the only historical papers published during the year.

E. Text Books, etc.—Dr. Killebrew's little book "Grasses, Meadows and Pastures," and Dr. Sturtevant's pamphlet on "Indian Corn" (reprinted from the 38th Rept. of the N. Y. State Agricultural Society) deserve mention here on account of their botanical interest, in addition to their high agricultural value.

"Botany for High Schools and Colleges," Holt & Co., N. Y., by C. E. Bessey, appeared early in August. It consists of two hundred pages of general anatomy and physiology of plants, followed by three hundred and seventy-five pages devoted to the special anatomy and physiology of plants, and outlines of their classification. Under the first, protoplasm, the plant-cell, cell-wall, formation of new cells, products of the cell, tissues, tissue systems, intercellular spaces, plant-body, chemical constituents of plants, chemical processes in the plant, relations of plants to external agents, are successively discussed. In the second part the characters of the seven grand divisions (sub-kingdoms) of the vegetable kingdom are described; the limits of the classes, cohorts and orders are briefly outlined, and their structure illustrated by selected examples.

A second revised and enlarged edition of Volney Rattan's "Popular California Flora," was issued about the middle of the year from the publishing house of Bancroft & Co., San Francisco. As enlarged, it consists of a hundred and fifty-six pages, including twenty-four pages of introductory matter, followed by simple descriptions of the less difficult plants selected from the flora of West-central California.

By far the most important botanical book of the year, was Sereno Watson's Vol. II of the "Botany of California," including Apetalæ, Gymnospermæ, Monocotyledones, Vascular Cryptogams, Musci and Sphagnaceæ. Dr. Engelmann elaborated the oaks, the pines and their allies, and the Loranthaceæ; M. S. Bebb, the willows; Wm. Boott, the Carices; Dr. Thurbur, the grasses, and Professor Eaton, the vascular cryptogams. A valuable "List of Persons who have made Botanical Collections in California," is appended, by Professor Brewer. The two volumes of this now completed work, aggregating nearly twelve hundred pages, stand as a most pleasing monument to the ability of the authors on the one hand, and on the other to the generosity of the business men of California, who voluntarily defrayed all the expenses of preparation and publication.

F. Periodical Publications.—The *Bulletin of the Torrey Botanical Club* and the *Botanical Gazette* continued throughout the year as our only exclusively botanical journals. Each gave good evidence of substantial growth. The botanical departments of the *American Journal of Science* and the NATURALIST were maintained as usual. Botanical articles frequently appeared also in the *Gardener's Monthly, American Agriculturist, American Monthly Microscopical Journal* and the *American Journal of Microscopy.*

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EFFECTS OF REVERSION TO THE WILD STATE IN OUR DOMESTIC ANIMALS.

BY HON. J. D. CATON.

A UNIFORMITY of form, color and habit in individuals among the various species of wild animals, is almost universally observed, and the loss of this uniformity under the influence of domestication, if less universal, is very general. How long it took to produce these changes in the horse and the ox, the sheep and the goat, we cannot know, for these were subdued to domestication before events were recorded which might tell us of the struggle. That some animals were more readily influenced by domestication than others, we know. How readily the wild turkey changes in form, color and habits under the influence of domestication I have demonstrated by my own careful experiments, an account of which I gave in the AMERICAN NATURALIST for June, 1877. That the domesticated reindeer of Lapland have become parti-colored, while their wild brethren of the mountains all about them retain a uniform color, I have shown in "The Antelope and Deer of America," p. 330, and in "A Summer in Norway," p. 223. The deer in the parks of England and Ireland have become unstable in color, although they have been subjected to the influence of domestication for a much shorter period than have the reindeer of Lapland. These are the most striking instances among the quadrumana, which occur to me, to enable us to compare the wild with the domesticated animals, although the wild horse and the wild ass are still met with in Asia, and the wild ox still existed in Scotland till within very recent times at least, but it may be well doubted whether the wild cattle of Scotland are the progenitors of our domestic ox. The domesticated buffalo, as seen in Southern Europe and Asia, and in Northern Africa, has degenerated less in both color and form than most other quadrupeds under domestication, and his wild habit still possesses him to a certain extent.

The wild boar submits to domestication with remarkable docility, and human care changes its form, color and habit in a very short time and in a remarkable degree. Human care, by judicious selection, may fix varieties of all these domesticated animals with persistent characteristics, but immediately his supervising care is withdrawn, all these peculiarities disappear.

Of the birds, perhaps the peacock resists the influence of domestication with the most persistence, though the guinea fowl undergoes no perceptible change from generation to generation, with rare exceptions.

While all have had opportunity to observe the changes which have been wrought in our domesticated animals by human care and supervision, opportunities have not been so general for observing the effects upon our domesticated animals when allowed to return to the wild state. My observations lead me to the conclusion that the tendency is not only to return to the wild habit, but to the original form and coloring of the remote wild ancestor. That there is some law governing this reversion we may well believe, though we may not be able to fully understand it yet.

My own observations tend to show not only a tendency, at least in some species, to revert to the original form and color of the wild ancestor, but they also suggest the possibility that this tendency is the strongest in those cases where the domesticated animal has most recently been reclaimed from the wild state, or in those cases where the change produced by domestication was the most rapid.

I have had the best opportunities for studying this subject in the Hawaiian islands. With the exception of the goose and the duck, nearly all of the animals which have been introduced into those islands since their discovery, as well as those which were then held in domestication,[1] have reverted to the wild state.

[1] They had the hog and common fowl when discovered by Cook.

Among these I may mention the ox, the horse, the goat, the sheep, the hog, the dog, the cat, the turkey, the peacock and the barnyard fowl. Where I had not the opportunity of studying these personally, I spared no pains to gather the facts from the most reliable sources.

The greatest physical degeneracy was observed in the wild horse and the wild sheep. The ox was introduced by Vancouver, less than a century since, upon the island of Kauai, from California, whence it was introduced upon the other islands. At most it has been subject to the new influences scarcely three quarters of a century. During that time no appreciable change has taken place in the coloring of the ox, nor much in his form, but his habit is wild and wary, fleeing from man in alarm; and he has acquired great fleetness over the lava beds in the mountainous regions which he selects for his home. While he is terrified at the approach of man; when wounded or hard pressed he becomes bold and aggressive, and is a dangerous enemy. In some parts of the islands they have become so numerous that the scarcity of sustenance has forced them down into the lower regions, where it is feared that they may destroy the forests upon which it is supposed much of the rain-fall depends. Indeed, on the Island of Ouahu a large district of country was pointed out to me which was said to have been once a forest, and was now entirely destitute of arboreous vegetation. This change was attributed to the wild cattle. They are hunted for their hides alone.

I saw none of the wild horses or wild sheep, neither of which are numerous. I was told that the former are much more degenerated in size, form and vigor than those on our western plains, which may be attributed to the want of an abundance of food adapted to their requirements in the elevated regions which they affect, but in habit they are as wild as the cattle.

The wild sheep, which are very limited in number, and I met with few who had seen them, were small, gaunt and long-legged, with a scant and coarse pelage.

The wild goats are very numerous, especially in the mountainous regions of the eastern islands. During the afternoon which I spent viewing the wonderful sights from the rim of the great extinct crater, Haleakala, I saw two bands of wild goats within the crater. I sat ten thousand feet above the sea. The chasm before me was seven miles across and two thousand feet deep. Its vertical walls in a few places had been partially broken down, so that bunches of grass had taken root on the shelves or steps formed in the disintegrated lava, and the goats were clambering about, leaping from shelf to shelf, seeking food. Towards evening they descended to the floor of the crater and disappeared in its eastern arm. With the naked eye they could not be identified, although one band was directly beneath me, but a good field glass revealed them very plainly. A large majority were snow white, some were parti-colored, and one appeared to be black. Their natural capacity for climbing has no doubt been improved by their reversion to the wild state. They are very wild and cautious, and difficult of approach by the hunter. They, too, are hunted for their skins.

The most marked and rapid change is produced in the hog by his emancipation from the restraints of domestication and the care of man. In a single generation he changes in form, color and habit from the staid and quiet porker to the fleet and fierce wild boar. The latter is the character as described to me by all who had been interested to make observations on the subject, of the numerous wild hogs now roaming in those islands. Col. Chas. Judd assured me that many years before a lot of hogs escaped from his ranch on the easterly side of Ouahu and went into the mountain which bordered the ranch. Among them was an imported boar. Before he could find them they had become so wild that he could not reclaim them from their mountain fastnesses. He got sight of this boar many times during several succeeding years. He was so marked that he could readily identify him. The change in form and habit were almost immediate. He soon became wild and almost as fleet as a deer. His body became thin, his back arched and his legs *appeared* to be much longer than when he escaped. Much slower was the change of color, but this finally occurred to a very appreciable extent, so that in a few years he had distinctly assumed the dark sandy shade of the wild boar. He wisely forbore to shoot him that he might study the developments which he saw going on. In the third or fourth generation the pigs showed very distinctly the sandy shade and stripes observed on the side of the young of the wild boar. From these and similar observations, I should infer that it would not take very many generations, with proper care, to completely domesticate the wild boar.

I heard of but two places where the pea fowl had gone wild. The first was at the plantation of Col. Judd, before mentioned, and the other was the plantation of Capt. McKee, on the Island of Maui, whence the birds had escaped and gone into the mountain above. No change was observed except that they had become wild, but not excessively so, and I did not learn that they had been much hunted in either case.

At what time the domestic turkey was first taken to the islands, I did not learn, but probably not very long after their discovery, or certainly soon after the arrival of the first missionary, which occurred in 1820. We may safely assume that soon after, some of them wandered away and reverted to the wild state, and now they are found, more or less abundant, in the forest regions of most of the islands. They have not yet beome as wary and difficult of approach as are the wild turkeys here. The natives trap them with some success. At Haiku I found two hens in confinement which Mr. Dickey had purchased from a native who had caught them. I studied them with great interest. They were in a large poultry house, the front of which was closed with slats. On approaching them they showed about as much alarm as our wild turkey would, similarly situated. A very decided tendency was shown to revert to the color of our wild turkey. The legs had already assumed a lightish color with a pink shade, though not so brilliant as in the wild ancestor, but quite unlike the black leg of the black tame turkey. The color of the plumage had also undergone a marked change. The ends of the tail feathers and of the tail coverts had assumed a tawny or russet shade, hardly so pronounced as in our wild turkey, but a great departure from all tame turkeys. My observations in domesticating the wild turkey show that they first degenerate in their coloring in these two points. The white bars on the wing feathers were there, but they are not always absent on the domesticated turkey.

In form, too, a change was manifest; the legs were longer and the body was longer and more erect than in the tame bird. Altogether the tendency to revert to the form, coloring and habit of their wild ancestors was very marked. I say their wild ancestors, for I think I showed satisfactorily, in a paper published in this journal for June, 1877, that the domestic turkey of this country is descended from our wild turkey.

I heard of the barnyard fowl which had gone wild in several parts of the island, but I did not see any of them. I obtained the most satisfactory account from Mr. Emerson, a son of one of the early missionaries who was located at the north-west end of the Island of Ouahu, where the son still resides. The domestic birds escaped from his father's place at least fifty years ago, and occupy an extensive elevated or mountainous wooded country. They still nest on the ground, and are quite numerous, in spite of the depredations of the wild cats. Although he has often seen them they are the most wild and wary of any animal he had ever attempted to approach, and he was very rarely able to shoot one. At the approach of day the whole forest would be vocal with the crowing of the cock, and although secreted right among them, when daylight came not one could be seen, and all was as still as if nothing had ever disturbed the quiet of the wilderness. How they managed to disappear so quietly in the gray of the morning he could not explain, for he never heard them fly from their perches in the trees.

They had diminished appreciably in size, and had assumed a uniform buff color. Now I confess that I do not know the color of the wild bird from which our barnyard fowl, or that which was common in the States sixty years ago, is descended, but if, as I have ventured to suggest, there is a tendency, when domesticated animals revert to the wild state, to return, not only to the wild habit but to take on other peculiarities of their wild ancestors, from which they had departed under the influence of domestication, then we may infer that the original wild stock was of a buff color.

I do not know that this subject has been deemed worthy of observation by naturalists, at least I have not been so fortunate as to meet with any discussion of it, but I hope an amateur may be allowed to so far depart from precedent as to make observations in out-of-the-way directions. It may be that my inclinations have too much of a practical tendency for strictly scientific studies. I study the bones but little, for practical utilitarian features interest me more.

ON THE MICROSCOPIC AND GENERAL CHARACTERS OF THE PEACH TREE AFFECTED WITH THE "YELLOWS."

BY W. K. HIGLEY.

[*Continued.*]

METHODS OF DISSEMINATION.

I DESIRE under this head to simply discuss the views of others, and in doing this to present my own views upon the subject. First, then, I will consider the belief of some that the yellows may be transmitted from one tree to another by the agency of insects, especially the honey bee, by carrying the pollen from one flower to others. Believing, as I do, that this disease is due to a fungoid growth in the *aërial portions of the tree*, this theory appears to me very absurd, more so, perhaps, because there are no facts or experiments to support it. Consider for a moment. If this disease is due to a fungus, then it must be disseminated by the passage of the spores or living mycelia from the diseased tree to other trees, either in the immediate neighborhood, or perhaps to some distant tree if the conditions are favorable for their transportation. If this is the case, and all, I think, that have carefully considered the facts, must know that it is, why should the fruit of the fungus be concentrated in the pollen? Why is it that young orchards that have never borne become contaminated with this disease? Why is it that orchards in close relation with other orchards that are affected with the yellows do not become diseased? We cannot assume that the bees will not visit both orchards! And finally, why is it that in the same orchard with healthy trees only one or two trees catch the yellows, showing all the symptoms, and the second year only one or two, or at the greatest only a few in the immediate neighborhood become diseased? Are we to assume that the bees in their search after their food are limited and not allowed to approach only certain trees?

Perhaps this is strong language to use in the face of all that has been claimed, but until the above questions are satisfactorily answered, I shall refuse to believe that insects have anything to do with the dissemination of this disease.

In concluding the discussion upon this point I will quote from the Michigan Pomological Report for 1878. On page 255, *it* *says:* " Those who believe in the propagation of the disease by the agency of insects, maintain that the disease is never manifested upon healthy stock until after the young tree casts its first blossoms, and experiments for the purpose of testing their theory will be made by enveloping the young tree with netting, in such a manner as to exclude all insects during the period of bloom." However, the disease does appear very often on trees that have not blossomed!

On page 250 of the same volume, referring to the abnormal branching, it says:

" *This growth is the only means of detecting the disease in young trees or those not bearing.*" (The italics are mine.)

In the Pomological Report for 1873, under this head, the first and second methods of dissemination given, are as follows:

1. " By the intermingling of healthy roots with those of diseased trees.
2. " By planting a healthy tree in a hole whence a diseased tree has been removed."

As I have stated before, all the roots that were examined by me, presented no abnormal appearance except the looseness of the cells; in no case were any filaments of a fungus found in the tissues, nor any spores, nor any indications that a fungus had ever been present. Those that claim that the disease is caused by a root fungus, have never, to my knowledge, found any species of fungi that is peculiar to the peach root, which is not found in many other roots as well. In my examinations I have found fungi growing upon the outside of the larger roots, but in every case I have turned immediately to the oak root and found the same condition of things there, and the oak did not have the yellows, and as far as could be seen, no disease of any sort. Not having found any signs of a fungoid growth in or on the root that is not found on the roots of most any tree, I do not believe that this disease can be transmitted from one tree to another by the first means given above.

As to the second, if the fungus that causes the disease has had time to mature and give off its spores, it is probable that many of them would fall upon the ground round about the base of the tree, and thus, if the tree is removed and another put in its place, the spores may, by some means, get upon the bark of the new tree and there, germinating, push their filaments into the tissues.

But this can not often be the case, as cases are on record where orchards have been planted on the same ground from whence diseased trees have been removed, and remained healthy.

FIG. 1.—Healthy limb of peach tree.

I have no doubt that by using the buds of diseased trees in budding, the yellows may be carried from tree to tree; for living mycelia or some of the fruit-bearing filaments may be present in the bud and thus when placed in the new tree the fungus continues to grow and the spores to germinate, and soon the tree succumbs to the disease.

The transmitting of the spores or mycelia by the pruning knife, is still an obscure method of dissemination. There is no doubt, however, that the disease is carried in this way very often.

Another and very important method of dissemination, is the transplanting of trees from diseased districts. Perhaps and probably, the yellows is introduced into new localities as often in this way as in any other. We can not accuse any one of dishonesty in selling plants which are diseased, for many do not know what the symptoms are, and still others honestly believe that it is nothing of importance.

I have left what I consider the most important method until the last. It is the spreading of the disease by the germs or spores being carried by the wind. It seems to me that the appearance of the yellows in isolated places and localities is strong evidence of this. Some may ask, why is not the disease more general if this is the case? I think that it can be affirmed that the disease is already general. It has been reported from all the leading peach districts and new localities are found every season. Especially is its sudden appearance in orchards at a short distance from infected districts to be taken into account. It is well known that no matter what the conditions of the atmosphere may be, the spores of fungi are always floating about, wafted hither and thither, lighting upon various organic individuals, until the true host is found, and then remaining only to send into the tissues its filaments, forming its mycelia, and finally throwing off other spores to be transported in a like manner as were those of their parent. If this trouble has its origin in a fungoid growth, the spores are just as certain to be carried from place to place by the wind as are those of any other species that grow upon other plants.

It will be seen from the above discussion upon this division of the subject, that I have included what is generally placed under the head, "Is this disease contagious?" Believing that it is not a constitutional disease, but one due to a parasitical vegetable growth, I think that it is more proper to say that the disease is disseminated in this way or that, rather than to say that it is contagious and may be caught by the healthy tree.

CAUSE.

The most important part of the discussion we now have to consider; for, knowing the cause, we can then suggest a remedy much more easily.

FIG. 2.—Unhealthy limb, showing the abnormal branchlets.

The yellows have been attributed to both animal and vegetable origin as well as to exhaustion of the system of the tree. The former has had many advocates, but these are becoming fewer every season. As no facts in support of this theory have ever been published to my knowledge, I shall consider it no further.

The weight of the evidence is in favor of the vegetable origin, and, from my observations, I firmly believe that it is due to a fungoid growth. Thos. Taylor, of the Department of Agriculture at Washington, claims that he may have discovered the cause of the disease in a species of Nœmaspora. But the same form is reported as occurring on other trees that received no harm from its presence. Spores of this genus are known to be in the air, and may as often light on other trees as on the peach; and it has been demonstrated that they will develop upon the oak bark as well as on that of the peach, when the conditions are favorable. Some may wish to ask: "Is not that upon the oak a different species?" This is a just and scientific question that immediately arises when such a fact is reported in an investigation like this; my answer will be apparent soon. First, however, let us see how Mr. Taylor proceeds to experiment: [1] "On the 1st of July last I commenced a series of experiments, by the moist process, with the bark of a peach tree affected with the yellows. Into five glass receivers I placed, respectively, a few drops of water, just sufficient to form a moist atmosphere in each. Into No. 1 I put a piece of bark affected with the yellows; into No. 2 a piece of bark from a healthy peach tree; into No. 3 a handful of peach leaves from the unhealthy tree; into No. 4 a similar quantity from the healthy tree; and into No. 5 portions of bark from the healthy and unhealthy trees mentioned. All the specimens were secured from the outward atmosphere. The temperature of the room in which the specimens were kept was frequently at 90° F. *These conditions were highly favorable to the development of such fungous germs as mature under excess of heat and moisture.*" (The italics are mine.)

After due time has elapsed, he finds mycelia and spores of Nœmaspora on specimens in receivers Nos. 1 and 5, and says that seemingly the healthy bark in No. 5 was not affected by the contact with the unhealthy bark. We are left entirely in doubt as to what occurred in receiver No. 2. I have carefully followed his experiments in my own work, and am able to report that the same forms of Nœmaspora may be found on the healthy bark as well as on the unhealthy, and further, that the same forms are

[1] Mich. Pomological Report, 1872, p. 593.

also found upon and may be developed on the oak bark. I tried the experiment with two specimens each of the healthy and unhealthy peach bark, and also two specimens of the oak bark. The directions given above, from Mr. Taylor, were closely and carefully followed. The healthy bark used was from vigorous

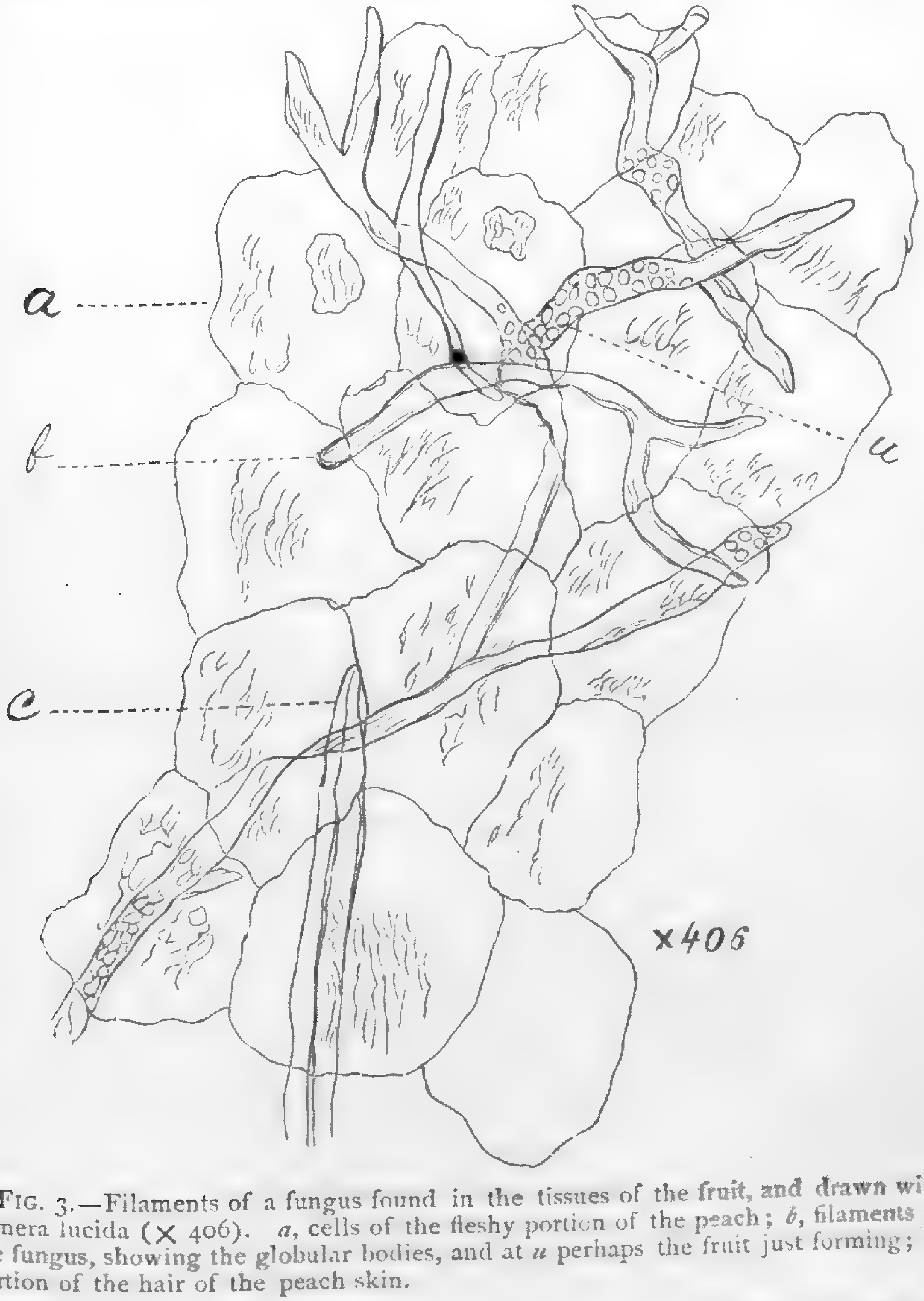

FIG. 3.—Filaments of a fungus found in the tissues of the fruit, and drawn with camera lucida (× 406). *a*, cells of the fleshy portion of the peach; *b*, filaments of the fungus, showing the globular bodies, and at *u* perhaps the fruit just forming; *c*, portion of the hair of the peach skin.

trees growing at my home in Ann Arbor, while the unhealthy specimens were from South Haven, Mich.

Some, and perhaps I might say many, think that the disease is caused by a fungus in the tissues of the root, but none, to my knowledge, has ever been recorded as occurring there. I have already sufficiently discussed this theory under the head *Dissemination of the Yellows*, and think that nothing further can be said about it unless more facts are brought to light. Nevertheless, I wish to quote a passage—a statement concerning this matter which my observations strongly confirm: [1]"The fungus found upon the roots of decayed peach trees is indigenous to all dead and decaying woods, and is the effect, and not the cause of such decay. Many thousands of trees which have been stricken by the disease, have been removed by 'drawing out;' the crowns, and roots of such trees invariably show a sound and healthy appearance."

Some have suggested that the disease might be zymotic in its nature. Mr. C. H. Peck, State Botanist of N. Y., has examined diseased specimens with this idea before him, and his results I give in full:[2] "The juice of an affected peach was carefully examined, but a power of four hundred diameters failed to reveal any spores or ferment cells. Thin sections of the leaves were made, and the leaf cells examined. A marked difference was observed between the cells of leaves from healthy trees and those of leaves from diseased trees. In the former the cells were well filled with a uniform mass of green chlorophyl, in the latter the chlorophyl was badly disorganized, very much broken up, shrunken and discolored. Many of the cells appeared to be nearly empty, and one or more minute, globose, shining bodies were seen among the fragments of the chlorophyl. An important step seemed now to have been taken in the investigation, but farther examination convinced me that these shining bodies were only the altered nuclei of the chlorophyl. It is scarcely possible that they could be foreign organic bodies, for how could they enter the walls of the unruptured cells? It was found that leaves discolored by the attacks of insects had the chlorophyl of the faded cells in a similar shriveled and abnormal condition. Various autumnal leaves, colored by nature's process, show similar shining nuclei in their cells, which also sometimes have their endochrome in a collapsed condition. Nothing like a ferment cell was disclosed in the leaves; but whatever may be the cause of this peculiar condition of the chlorophyl in leaves from affected

[1] Michigan Pomological Report, 1878, p. 254.

[2] *Cultivator and Country Gentleman*, Oct. 30, 1879.

trees, it is easy to see that it must be a serious matter to the tree. The leaves are its lungs and its stomach. Respiration and digestion are carried on through them. If, then, the active vivifying power of the chlorophyl is impaired, as it must be in such a disorganized condition, the sap must cease to be properly elabo-

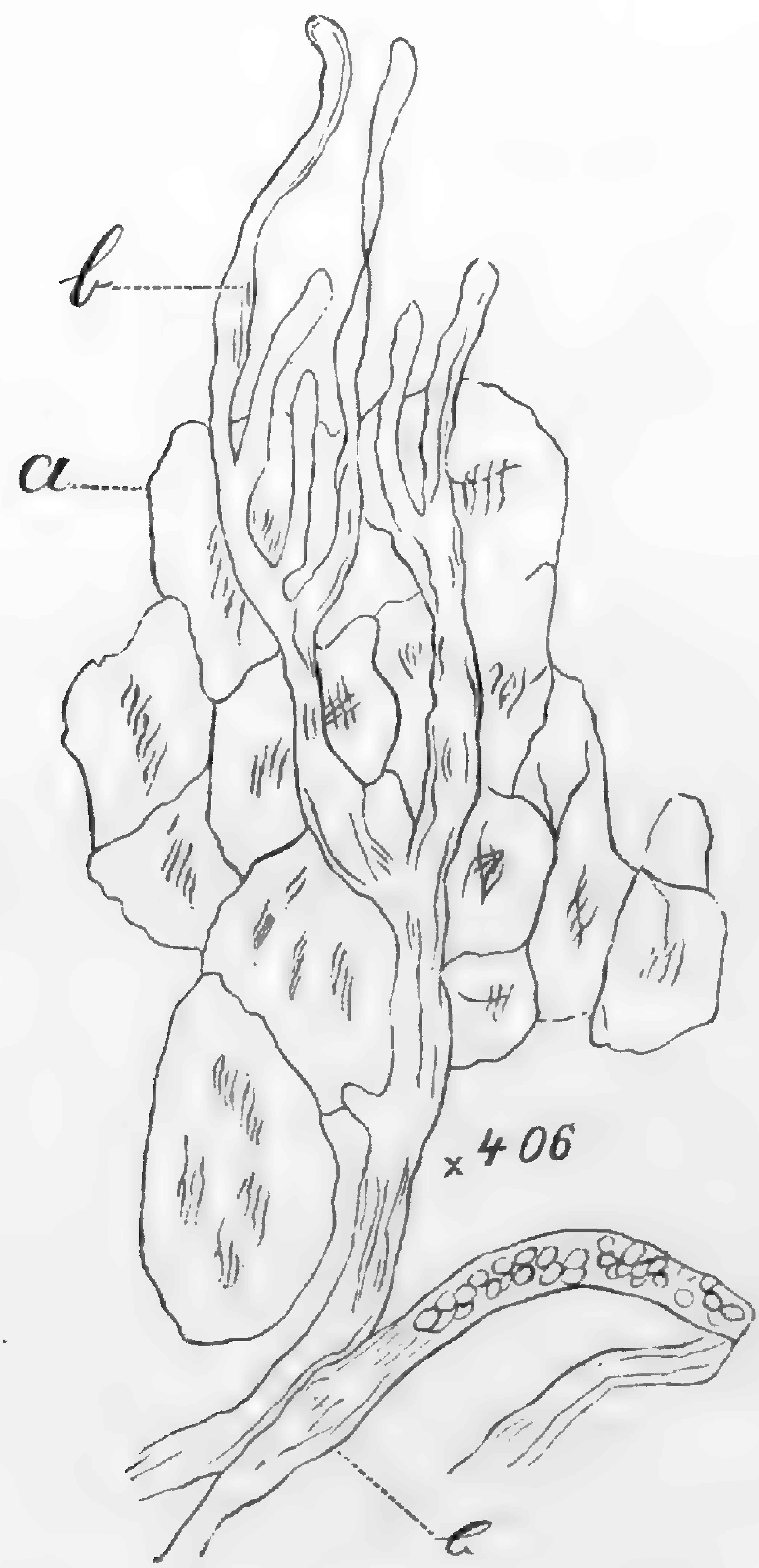

FIG. 4.—Same as Fig. 3.

rated, and the tree must suffer. It is very much as if a man were afflicted at one time with both consumption and dyspesia. No wonder that the tree at length dies."

To observe the action, method of growth, position and the character of this intruder, has been the object of my work since the 1st of August, 1878. I have endeavored to do my work carefully, microscope in hand as a constant companion, and will now give the results of my labors, and present what I verily believe to be the cause of the disease.

From the start I have worked with this idea before me; that if the disease was caused by a fungus, this particular fungus must be present in the tissues of the tree as it stands in nature, or, in other words, *the conditions natural to the growth of the tree must also be natural to the development of the fungus.* Making this the basis of my observations and experiments, I did not produce the conditions favorable for the growth of most fungi, viz., a moist atmosphere or a high degree of warmth, but simply examined the specimens as they were gathered from the diseased trees and sent to me. The specimens, when I examined them, were all in good condition; the fruit was not in the least decayed, but in all particulars perfectly natural. Some of the peaches were immediately sliced and placed in alcohol on their arrival, and others were examined while fresh. The results were the same in both cases.

For the sake of convenience I will give the results of the examination of each part of the tree in the order of succession of those parts.

1. Roots.—First, a specimen four inches long and about one-eighth of an inch thick was examined; sections being made one-fourth inch distant from each other. Second, a root four inches long and one-half inch in diameter, sections being made as before. Third, a root of the same length and one inch thick was examined as in the first specimen. Fourth, sections cut in no regular order from roots of various sizes and trees. All of the above sections were examined with objectives varying in their magnifying power between 75 and 625 diameters, and in no case was any fungoid growth seen in the tissues nor anything in the least abnormal except the loose structure which has been mentioned before.

2. *Trunk.*—Many sections were made from various sized specimens, the largest two inches in diameter, and the smallest, one inch. Sections of the bark showed rather too much coloring matter; and in the inner bark of the larger specimens I noticed an abundance of mycelia, the characters and appearance of which will be given under the head *Fruit.* The smaller specimens did

not show near as much of the fungoid growth as did the larger, and, indeed, I examined several sections before I found any mycelia at all. In both cases it was situated on the under side of the inner bark, next to the cambium layer, and many of the filaments penetrated and ramified through this layer. I also noticed, in the larger specimens, mycelia between the layers of wood. An examination of the abnormal pigment spots, scattered through the pith and woody portions, revealed nothing but cells filled with the coloring matter. The outer bark in no case showed signs of any fungoid forms.

3. Branches.—An examination of the larger branches revealed nothing at all different from that given above for the trunk of the tree; but some of the smaller branches and the growing ends of the larger or main branches, showed marked peculiarities indeed. In these the tissues seemed to be completely filled with mycelia, and in one case the bark was apparently split.[1] The branches from which these specimens were taken had many abnormal branchlets, and hence the theory advanced in the first part of this paper that these abnormal shoots were caused by the filling up of the tissues of the growing ends, thus turning the flow of sap to the lateral buds.

The filament found in the branches was in all respects identical with that found in the trunk of the trees, and will be described further on.

4. Leaves.—Those examined were mostly from the abnormal branchlets. The chlorophyl in all was completely disorganized, and in general the appearance was the same referred to by Mr. Peck. It seemed at first that this must be caused by dry weather or lack of cultivation, but on further examination filaments of a fungus were found to be present, to a greater or less extent, in nearly all the leaves examined. I noticed but two spores of any sort in the tissues, these were teleuto-spores and without doubt belonged to some leaf fungus other than the one the filaments of which were found in the tissues. On a few of the leaves sent me I found the fungus *Ascomyces deformans*, which causes the "curl leaf" disease so common at the present time in many localities.

The filaments of the fungus alluded to first, were of the same character as those that will be described under the next head.

[1] A friend to whom I showed this, suggested that this splitting might have been caused by the pressure of the growing mycelia within the tissues.

Mr. Thos. Taylor says, that [1] "it is evident that the healthy leaves possess an antiseptic substance which prevents the growth of the common moulds on them." The results of my experiments have led me to the same conclusion. An analysis of the

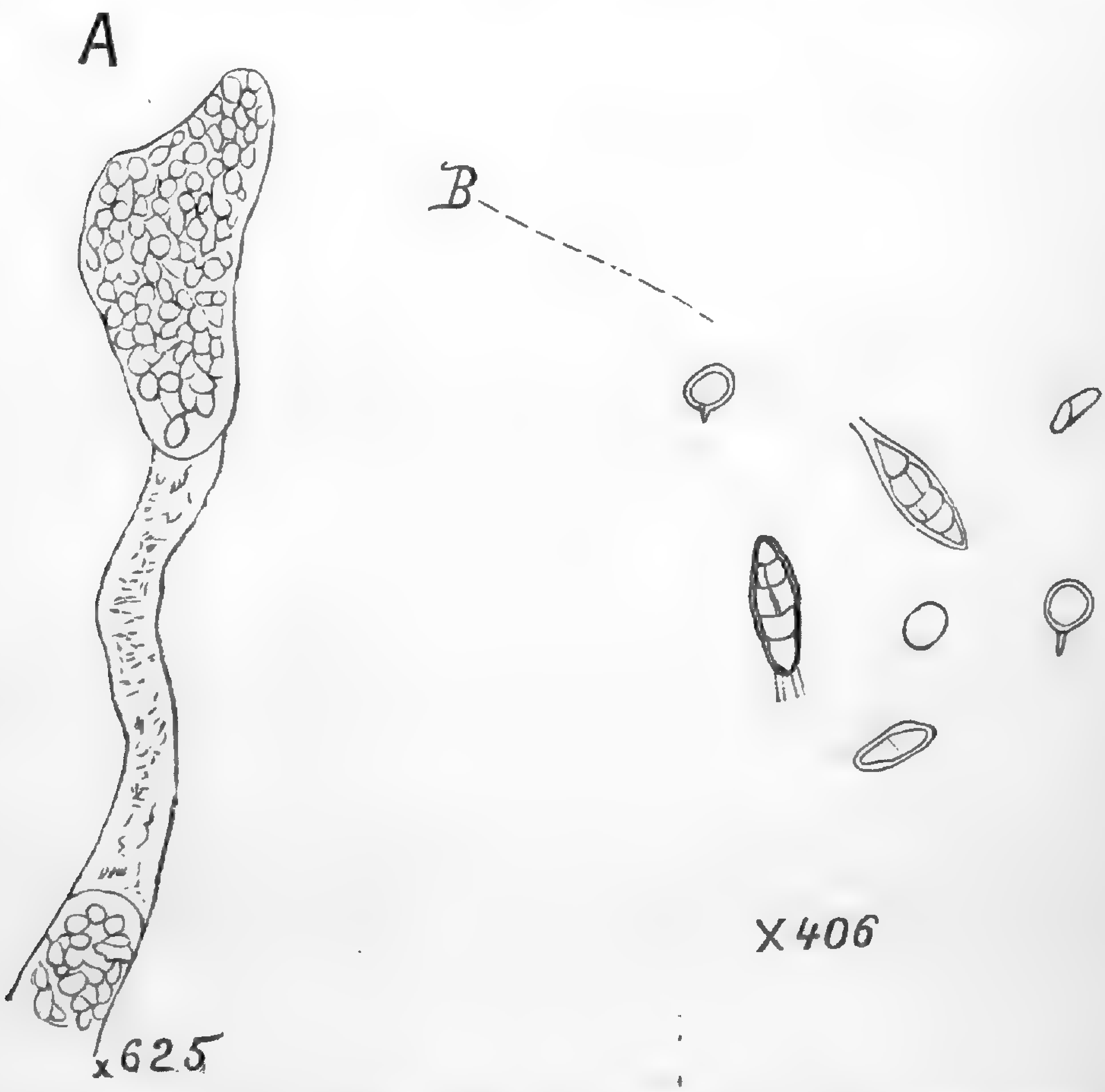

FIG. 5—A, fruit of a fungus found just beneath the skin of the peach. This resembles a portion of the fruit of the Saprolegnieæ (× 406); B, spores formed in the peach. Drawn with the camera lucida (× 406).

leaves show that there is a much larger proportion of moisture in the diseased leaves than in the healthy. I analyzed several specimens of each and found a greater difference between them than Mr. Taylor reports.[1] However, this is not important, as the per cent. may and does vary much. The average of my analyses was as follows:

HEALTHY LEAVES.

Moisture	25.62
Organic matter	69.24
Ash	5.14
	100.00

[1] Mich. Pomological Report, 1872, p. 597.

UNHEALTHY LEAVES.

Moisture	39.16
Organic matter	57.08
Ash	3.76
	100.00

There is a small per cent. of volatile matter in the leaves that in the estimation would raise the per cent. of moisture slightly.

It will be seen from the above results that the unhealthy leaves are much better fitted to become the host of a parasitic fungus than are the healthy ones.

As to what causes this abnormal amount of moisture, I have already formed an opinion, but desire to confirm it by further experiment, the results of which I hope to include in a future paper devoted entirely to this subject.

5. Fruit.—I found that the most satisfactory results were to be obtained from an examination of the fruit, and therefore spent the greater part of my time upon that portion of the tree. Mycelia in abundance were found just beneath the skin, extending into the fleshy parenchyma a short distance. This fungus—identical with that found in the other parts of the tree—was unicellular, branching, and much enlarged in places. In some places the filaments were apparently filled with small oil globules and bodies closely resembling spores. In only a single instance did I find a distinct fruiting filament. That I did not find more of the fruit I regret very much, for in order to know fully the characters of a fungus, its fruiting system must be carefully studied.

The single specimen of the fruit I examined is shown on Fig. 5. It was found beneath the skin of a prematurely ripened peach, detached from the remaining filaments present with it, and yet evidently it belonged to the same growth.

Several peaches were examined, and in no case did I fail to find the same branching form.

The method of branching and the form of the filament (shown on Figs. 3 and 4), as well as the oil globules which they contained, and the fruiting system of this fungoid growth, immediately reminds one of Saprolegnieæ, to which division of fungi this form seems to belong. And as the final result of my investigation up to the present time, I believe this parasitical vegetable form to be at least a part of, and probably the whole cause of this disease.

Many modes of procedure have been suggested to effect a cure and thus save the trees. Those persons advancing some of them claim that their *modus operandi* is a sure and active agent in bringing about the desired end. But most of the modes are simply theoretical and always fail. In most cases when a cure has been reported, it has afterwards been proven that the tree did not have the yellows at all. For example, one who attributed the yellows to an animal origin, used Paris green, throwing it over the tree with a pump, and the next year the trees that he supposed to be diseased were in a healthy bearing condition. It was afterwards shown that the symptoms of the yellows were

X 406

FIG. 6.—Hairs on the skin of the peach (× 406). Drawn with camera lucida.

produced indeed by an animal, but that animal was simply a plant louse! The tree being covered with them, the Paris green was an effective agent in ridding the orchard of its pest.

Some have used hot or boiling water, pouring it about the roots of the trees, and in many cases they have reported the disease reduced; but in every case that has come under my observation it has failed.

It is not at all surprising that the means used—including the whole category of remedies—have often been reported as producing a satisfactory cure, for *many of the temporary injuries liable to come upon a tree, will, in most instances, produce many of the symptoms of the yellows;* these are the cases that have been cured. If they had been left alone nature's physician would have cured them also. *Nature does not cure the yellows.* A severe frost will kill the heart wood of a tree, producing some of the characters of this disease, but the exterior—the vital part—remaining unharmed, it will soon return to its healthy condition.

Disinfectants have been recommended. Mr. A. G. Gulley says upon this subject:[1] "But I look with hope in another direction, that of preventives by which we can disinfect the trees or enable them to resist or throw off the disease. This idea is strengthened by the evidence that a fungus may be the cause. We know that the low forms of vegetable life are destroyed by various substances and cannot exist in their presence. If the disease is of that nature, by the introduction of some of those materials we shall disinfect the trees, destroy the germs or prevent its growth."

We agree with Mr. Gulley in this, but as far as experiments have been tried, the right substance has, as yet, not been found, and it is a query whether or not the very agent that may be destructive to the fungus may not also, being unnatural in the circulation of the tree, destroy it also.

Mr. Taylor[2] recommends the use of sulphates and alkalies as a wash to be used on the bark and roots of the trees. It must be borne in mind, however, that he is inclined to attribute the disease to the agency of a species of Nœmaspora, which I think has been clearly shown is not the cause, but that the fungus that produces the yellows, both fruit and mycelia, is more internal than he claims, and would thus necessitate the introduction of the acid, alkali or any disinfectant into the circulation, which would produce an abnormal condition of things physiologically, and injure the tree itself. I have no doubt, however, that if enough of these reagents were used the fungus would be destroyed.

Dr. Kedzie's recommendation[1] of the use of potash and phosphoric acid or superphosphate of lime as an experiment, we consider as simply a good preventive, and have discussed it under that head.

From my work and observations, and from, I think, a scientific standpoint, letting theories alone, the only cure that I can recommend, is, that the fruit grower, when he notices that any tree in his orchard has become diseased, root it out carefully and burn

[1] Mich. Pomological Report, 1878, p. 252.
[2] Mich. Pomological Report, 1872, p. 596.

every part. If each one takes this care and is also careful to keep the orchard up to the standard cultivation, this malady, which is troubling our orchardists to such an extent at present, will surely fall and soon become a thing of the past.[1]

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INTELLIGENCE IN A SNAIL.

BY W. H. DALL.

SOME time since a relative told me a remarkable story about a child who had pet snails which recognized her voice and distinguished it from that of others. As such a development of intelligence has not hitherto been reported among mollusks, I was much interested. By the kindness of the lady from whom the story was first heard, and the intervention of Mrs. Lay, wife of Bishop Lay, formerly of Arkansas and now of Maryland, one of the family, who was cognizant of the facts, was reached, and an extract from her letter is appended. I may add that Mrs. Lay speaks in the highest terms of the accuracy and clearheadedness of her correspondent (then and now a resident of Arkansas), and remarks that both she and her sister were remarkable for the ease with which they established friendly and confidential relations with the birds and animals about them. The father of these ladies, whose name I suppress merely because I have not their authority to print it, was chief clerk in the State Department under the secretaryship of Daniel Webster.

The malacologist, familiar with pulmonates, will recognize in the following quotation many facts which indicate the accuracy and unusual powers of observation of the writer. It is probable that the snail was one of the group to which *H. albolabris* belongs, at all events it was a native of Arkansas and one of the larger species. It would be highly interesting if some of our lady friends would repeat the experiment with different kinds of snails, and determine by additional evidence whether they are capable—1st. Of recognizing a call or sound; and 2d. Of distinguishing it from other similar calls or sounds; which the snail in question appears to have done.

[1] Mr. David De Tarr, of the Zoological Department of the State of New York at Albany, and Mr. A. B. Covert, of Ann Arbor, Mich., were, during a part of the time of the above investigation, associated with me. To Mr. De Tarr may be credited the finding and drawing of the fungoid form figured on Fig. 4.

The lady, after stating that her sister Georgie was, from the age of three years, quite an invalid and remarkable for her power of putting herself *en rapport* with all living things, continues: "Before she could say more than a few words, she had formed an acquaintance with a toad, which used to come from behind the log where it lived, and sit winking before her in answer to her call, and waddle back when she grew tired and told it to go away. When she was between five and six years of age, I found a snail shell, as I thought, which I gave her to amuse her, on my return from a picnic. The snail soon crawled out, to her delight, and after night disappeared, causing great lamentation. A large, old-fashioned sofa in the front hall was moved in a day or two, and on it we found the snail glued fast; it had crawled down stairs. I took a plant jar of violets and placing the snail in it carried it to her, and sunk a small toy cup even with the soil, filling it with meal. This was because I had read that French people feed snails on meal. The creature soon found it, and we observed it with interest for awhile, as we found it had a mouth which looked pink inside and appeared to us to have tiny teeth also. We grew tired of it, but Georgie's interest never flagged, and she surprised me one day by telling us that her snail knew her and would come to her when she talked to it, but would withdraw into its shell if any one else spoke. This was really so, as I saw her prove to one and another, time after time. At one time she found a number of eggs. To the best of my recollection they resembled mistletoe berries, though much whiter. They hatched, and she had fifteen or twenty little snails which used to assemble round the cup of meal which had to be frequently replenished. The old snail once fell down on to a brick pavement and its shell was fractured and a small piece lost, but Georgie pasted a piece of calico over the hole and it seemed to do very well. What became of the happy family I do not remember, nor can I tell how long my sister had them. I do not know of any more easily kept pet. If there is anything else which I have forgotten, I shall be happy to write further particulars if I can recollect them."

"Georgie," my correspondent adds, "died about fourteen years ago."

An observer, who noticed and remembered the pink buccal mass, the lingual teeth and the translucent mistletoe-berry-like eggs, and after such an interval of time could so accurately describe them, is entitled to the fullest credence in other details of the story, and I have no doubt of its substantial accuracy, in spite of its surprising nature.

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BOTANICAL NOTES FROM TUCSON.

BY JOS. F. JAMES.[1]

IT is not very many years since the Territories of Arizona and New Mexico were regarded as the most forbidding countries in the world. Every one who went there carried his life in his hand, and if he escaped the fierce Apaches and returned home with his scalp and a whole skin, he was among the favored of mortals. Within the past five years much of this has changed, and the civilization brought about by the advent of railroads and the influx of determined miners, has been remarkable. A sojourn of some weeks in Arizona, gave me an opportunity to see some of the life of that quarter, and in this paper I purpose speaking of some things to be seen and found there.

The city of Tucson is the largest and most important settlement in Arizona. It is essentially Mexican; settled as long ago as the end of the seventeenth century, it is one of the oldest towns in our country, and from its foundation to the present time, it has continued to be the center of the trade of the Territory. Situated in the midst of the mining regions, it furnishes supplies to mines on the north, east and south, and for the State of Sonora especially, is a depot of supplies. It is estimated that at certain seasons of the year the trade between Tucson and Sonora amounts to as much as a million dollars per month, the imports to the United States consisting of fruits, tobacco and whisky, and the exports of calicoes and other dry goods. These are carried for a distance of 300 or 400 miles on the backs of mules through passes in the mountains, and on account of the extreme duties into Mexico, much smuggling is constantly going on.

The streets of Tucson are narrow and unpaved; many of them are a foot deep in finely powdered dust, and a sudden gust of wind, such as frequently arises, sweeping along the ground, raises a whirling cloud so thick that it is impossible to see across the street. All of the houses are built of "adobe," the Mexican

[1] Custodian Cincinnati Soc. Nat. Hist.

name for sun-dried mud bricks, are generally but one story high, and have flat roofs. This kind of a house, with walls often two feet in thickness, is said to be much cooler in summer and warmer in winter than any other, and the thickness of the walls ought surely to keep out both heat and cold. To keep out the heat, however, is a much more important consideration than the cold, in a climate where the mercury often rises to 120° in the shade, and sometimes to 125°. In the summer the heat is something fearful to think of, but the air is so dry and so pure, that a degree of heat unbearable in our climate, can be easily endured in that one. During the summer many of the people take their cots into the yard, on to the sidewalk, or on the house tops, and sleep with the sky for a roof. In Yuma it is a common sight to see, early in the morning, people getting up and making their toilets in the open air.

The bricks of the houses are about twenty inches long, eight inches wide and three inches thick. They are fastened together with a mortar made of earth mixed with water, the sidewalk often being dug up to furnish the principal ingredient. The houses are built in the form of a square or oblong, with a court in the center, thus allowing a free circulation of air and making the house much cooler. The better class have a covered porch, or "remada," round the court, and here the people sit and work during the day, and sleep during the hot weather.

There are many curious sights to be seen in and about Tucson, curious at least to Eastern eyes, but it is not my intention to speak of them here. During a stay of some six weeks in the city, I collected the plants of the immediate vicinity, and it is to them I shall refer at present.

The commonest plant of all the country about Tucson is known locally as the mesquite. Under this general name there are included several very distinct trees, but with the same general habit, which are all grouped under the name of mesquite. Sometimes they are scattered singly over the desert; and sometimes they are clustered together in a dense thicket. The trees are low and scraggley, with the branches sweeping the ground on all sides. They have handsome acacia-like leaves, and long branches of bright yellow flowers, succeeded by the pods which serve some of the Indian tribes as food. Concealed by the leaves are myriads of thorns in all stages of growth, but all hard, sharp and tough. In attempting to penetrate this brush, a gentle tickling at the back of the neck makes you aware of something in store for you, and as you turn to investigate, a branch seizes you by the sleeve, and another is prepared to enter your eye. Something sticking in your flesh

FIG. 1.—*Fouquiera splendens* Engelm.

calls your attention in another direction, and you find a cactus has fastened itself to your pantaloons. Devoting your attention to it, you finally succeed in detaching one thorn from your leg, and stick ten in your fingers, transferring them from one hand to the other with the greatest ease. Then your hat will be scraped off, your face will be scratched, and you will feel like saying something wicked. You think you see a bird sitting on a nest in one of the trees, and at the risk of your neck climb up to it, only to find it empty. When you reach the ground again, it is with a dozen thorns in your leg, more in your hands, and your face and neck bleeding from scratches. Should you try to sit down, you will find yourself located on a patch of ground already occupied by thousands of the sharpest kind of thorns; by this time you will probably have come to the conclusion that a mesquite patch is no place for a picnic and you vacate the premises.

Associated with the *Acacia greggii*, with yellow flowers in racemes, and long and crooked pods, is the *Acacia farnesiana*, a shrub from six to ten feet high, bearing great numbers of small yellow balls of flowers, which are very sweet scented. It is largely cultivated in China for the sake of the flowers, for out of them is made a delicious perfume. The creosote plant, *Larrea mexicana*, is very abundant on the deserts about Tucson, but a more worthless plant it would probably be difficult to find. Torrey says it is used externally for rheumatism; but no animal seems to feed upon it, and it is useless for fuel, for it can scarcely be made to burn.[1] It has been the subject of much discussion in California, and papers read before the Academy of Natural Sciences say that it produces such quantities of "lac dye," that a profitable business could be carried on by collecting and exporting it. As far as I have observed in examining a large number of bushes, a very small proportion only produces the material for the dye, and these in such small quantities as to make it hardly worth the trouble of gathering.

Still another very common and at the same time a very curious plant is the *Fouquiera splendens*, one of the Tamariscineæ, and known to the Mexicans as "ochotilla." It grows all over the deserts of Arizona and among the rocks on the mountains. The branches are long and whip-like, armed with innumerable sharp, curved thorns an inch or more long. The flowers are of a bright scarlet, and form racemes at the ends of the branches. The leaves are three-parted, sessile, and generally appear after the flowers have gone. It is used very extensively by the Mexicans for fences, and oftentimes one sees a fence of this plant, the pieces stuck into the

[1] Torrey's Report in Emory's Reconnoissance of N. Mex. and Cal., p. 138.

ground and bound together with raw hide and bunches of the bright scarlet flowers at the top of the stalk. The plant is cer-

FIG. 2.—Flowers of *Fouquiera* (*spinosa*) *splendens* Engelm.

tainly one of the most striking of all found on the deserts of Arizona.

Another form is the "Palo erde" of the Mexicans. It is the *Parkinsonia torreyana*, one of the Leguminosæ. It grows to be some fifteen or twenty feet high, and all the branches are of a light-green color. The flowers are of a bright yellow, in long racemes, and quite sweet-scented. Those trees noticed on the Colorado desert were surrounded by swarms of bees, apparently finding excellent food among the blossoms. When in flower, no leaves are to be seen, and when these come out they are very small and inconspicuous.

The cacti form a most conspicuous feature of mountain and desert. By far the most conspicuous and remarkable form is the *Cereus giganteus*, locally known as the "saguara" cactus. It was first brought to the notice of the scientific world by Emory's Expedition from Fort Leavenworth to San Diego, in 1848, and in his report was given its present name. It is an upright fluted or ribbed pillar, each rib covered from bottom to top with a mass of sharp, straight thorns. At the top of the stem are the long tubular white flowers, with the petals just peeping from the calyx, and with the interior filled with an innumerable mass of stamens. After the fruit is formed the flower, in drying, has the pleasant odor of Calycanthus. When ripe the fruit splits open at the top, displaying the bright red scarlet of the interior, dotted with the numerous small black seeds. It is much relished by the Mexicans, but to me has a mucilaginous and sweet, but insipid taste.

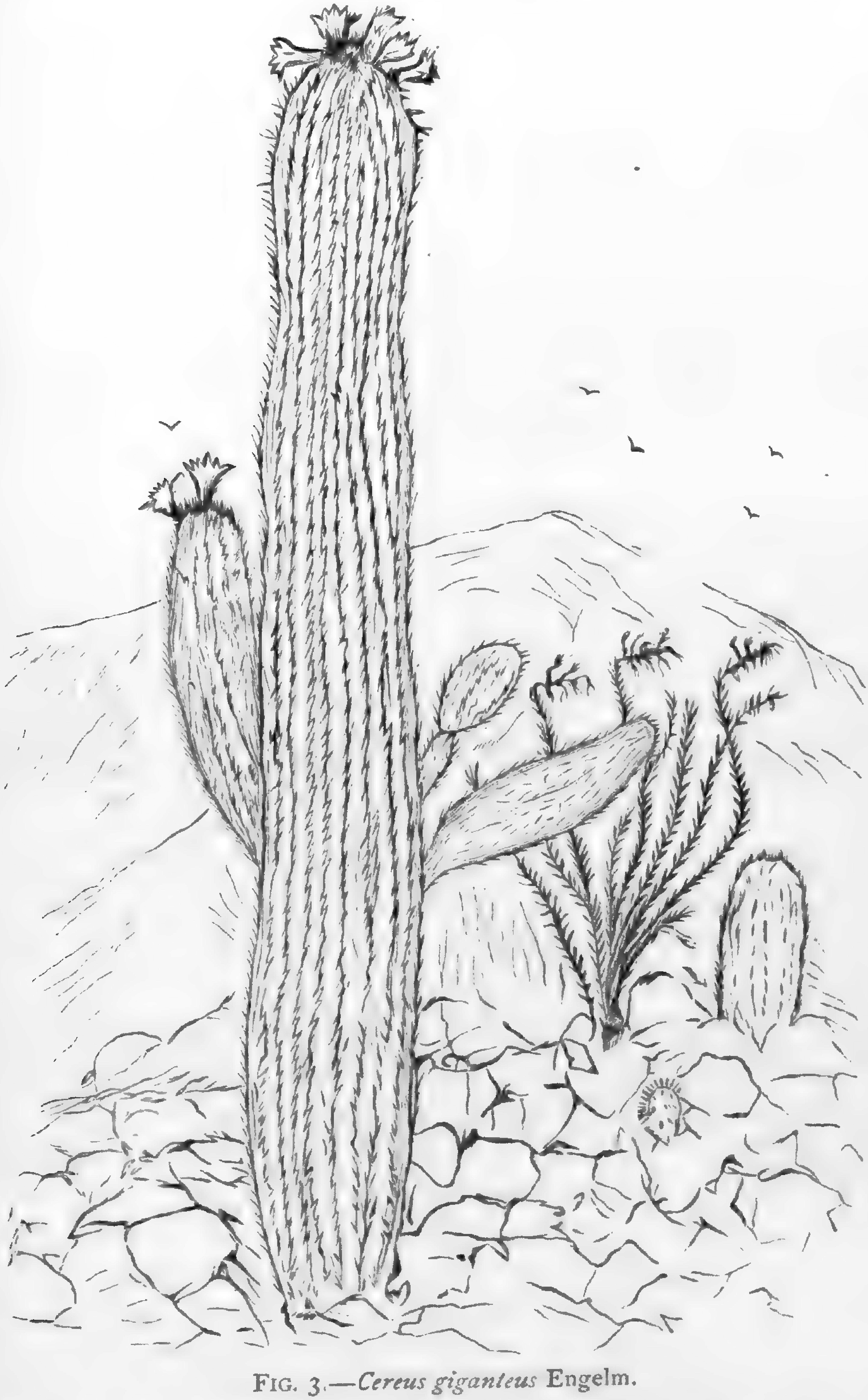

FIG. 3.—*Cereus giganteus* Engelm.

Birds are very fond of it and often secure it before any one else can get it. The bright red color of the inside of the fruit can be seen a long way, and doubtless serves to attract birds who can thus disseminate the seeds.

There is no more striking and conspicuous form of vegetation than this *Cereus giganteus.* It often grows to the height of thirty feet, straight as an arrow and of nearly the same size from bottom to top. The internal framework is made up of a number of hard woody cylinders, the spaces between being filled up by pithy matter; sometimes it is branched, but in a stiff and ungraceful manner, the branches jutting out almost at right angles and then turning and ascending parallel to the parent stem. Sitting on the rocks near some of these plants, when the wind was blowing strongly, the sound of it passing between the spines resembled strikingly the soughing of the wind through the branches of a pine tree; and shutting the eyes it required but little imagination to be transported to a northern pine forest, listening to the wind blowing through the branches. It is strange that the action of the wind in two such different localities as the hot deserts of the South and the cool mountains of the North; and playing upon two such different types of vegetation as a cactus and a pine tree, should produce sounds so similar to each other.

Another species of the family is one commonly called the "nigger-head" or "barrel" cactus, a Mammalaria. This often grows four feet high, sometimes only half as much, and almost globular in shape. It has many ribs converging to the top, and each bears innumerable clusters of spines. The lower ones are long, straight and horizontal; some of the central ones stand upright and the largest in each cluster is curved over so as to form a sharp hook. These are very tough, and while the crooked ones serve the Indians for fish hooks, the straight ones are used as needles. The flowers of this species are generally red. A much smaller species of this form, also a Mammalaria, is very common among the rocks on the mountains near the city. The spines are black and very small, but sharp. Still another species *(Opuntia arborescens)* grows sometimes to be almost a tree, and is covered with a mass of the most awful looking, and feeling thorns. These seem to be covered with a sort of sheath, easily removed, and easily sticking into one's fingers. The thorns are sharp enough and long enough to go through pantaloons and boot top, and stick viciously into the skin. The Mexicans call this the "ochoya" cactus, and often finding a straight plant and about the right size, will clean off the thorns, and then by much labor clean out the pith from the stem, leaving a stick which is full of holes of all sizes, and which makes a useful and ornamental cane. Then the common prickly pear (Opuntia) forms immense patches, covering acres of ground, and sometimes forming hedges eight and ten feet high. The fruit is known as a "tuni," and is eaten by the Indians and Mexicans. It is of a very mucilaginous nature, sweet and insipid, but not very palatable to ordinary tastes.

It is characteristic of many of the plants of the desert to be provided with thorns, and where there are many thorns there is relatively a small amount of leaf surface. The immense number of cacti are by no means the only spine-bearing plants, and one of the most remarkable, outside of that family, is the *Holacantha emoryi.* This grows in the dryest and most barren spots of the desert, and forms a large mass of what appears to be nearly all branches and thorns, but it is intermixed with innumerable clusters of small yellow flowers. The small leaves are not apparent when the plant is in bloom, but come out soon afterward. Another plant of a peculiar character, common at Tombstone, seventy-five miles south-east of Tucson, is the *Nolina texana.* It has a long branching spike of white flowers, intermixed with linear, sharp-pointed leaves. At the base of the stem great numbers of long sharp leaves spring in all directions, some being eighteen inches or more long, and presenting a formidable appearance. It abounds in the dryest localities.

Besides the desert itself, with its peculiar flora, there are one or two other places in the vicinity of Tucson which are excellent for plant gathering. One is in a patch of low ground where a small stream has been dammed up forming a pond which serves to keep the ground in the vicinity quite moist. Here some few familiar forms are to be found, mixed with others entirely unfamiliar. Among the former, growing very luxuriantly, is the *Ampelopsis quinquefolia*, apparently the same as the eastern form, *Cephalanthus occidentalis*, *Apocynum cannabinum*, *Samolus valerandi* var. *americanus*, *Medicago sativa*, *Scirpus olneyi*, similar to *S. pungens*, and *Juncus balticus*, a native of Europe as well as of the Eastern United States. Among the unfamiliar forms is *Amorpha californica*, a small shrub with pinnate leaves and long racemes of purple flowers, very similar in appearance to *A. fruti-*

cosa. Another is the *Antirrhinum maurandioides*, a pretty climbing plant, with large blue flowers and sagittate leaves. It is very common, and climbs over all plants within its reach. The *Cuscuta californica* grows in such profusion as to completely overwhelm many other plants, and gives a peculiar yellowish appearance to all, while *Convolvulus occidentalis*, with large white flowers, covers large patches of ground with its trailing stems. *Castilleia linariæfolia* is very common in patches, and is tall and slender, with bright red flowers and linear leaves.

Almost the only other locality in the neighborhood of Tucson favorable for the growth of plants, is along the Santa Cruz river, a small stream which rises to the south of the city, flows past it, sinks into the ground some ten miles on the other side, rises again to the surface, and finally empties into the Gila river. For some distance along its banks the Mexican women use it as a wash tub, and along a special part of it can be seen, at all times, numbers of women washing clothes. They beat them on the stones and wear out the clothes as much as take out the dirt. Near the stream, climbing extensively over the bushes, grows *Clematis drummondii*, with three-parted leaves and large clusters of white flowers. Here also is found the *Philabertia cynanchoides*, one of the Asclepiadaceæ. It has extensively twining stems, arrow-shaped leaves and small clusters of greenish yellow flowers. A mile further up the stream we come to where it has been run into a sort of canal to run a mill, and along the side of the mountain, below the canal, where the ground is always moist, is a good growth of vegetation. Here is found *Aster pauciflorus*, with long linear leaves, and flowers with blue rays in branched corymbs. The larger growth consists principally of willows and poplars, *Populus fremonti*, var. *Wislizeni*, being the most common. The *Tessaria borealis* is another tree with the aspect of a Baccharis and a willow. It has small, linear, silky leaves and rose-colored flowers in dense clusters. The down of the seeds is used extensively by the birds for lining their nests.

Along the banks of the stream is a little Hydrocotyle, a Ligusticum, *Eleocharis palustris* and other plants loving damp localities, and in the water *Ceratophyllum demersum*, *Potamogeton natans* and *P. pectinatus.* At the other side of the city, but still within the influence of the river, grows *Tribulus grandiflorus*, one of the Zygophyllaceæ. It has large, beautiful, orange-colored flowers, with pinnate leaves, hairy and procumbent stem, and is one of the most attractive flowers of the region. The *Juglans rupestris* grows sparingly along the roads, and a tall Acacia *(A. hirta ?)* with a straight branching stem, round bunches of white flowers and finely pinnate leaves, is quite common.

These are some of the plants which, in a short period of time, and at an unfavorable season of the year, can be found in the vicinity of this, one of the oldest settlements of America. I have by no means noticed all the species collected there, for I have not yet had an opportunity to identify them, and there are no doubt many more species to be found by one spending a year at the place. I have been informed by those who know, that during the summer rains many plants spring up, bloom for a short time and disappear for the remainder of the year. Among the species to be found here are doubtless many which are Mexican forms; but this is nothing strange, for the whole of the flora of Southern California, Arizona and New Mexico belongs to the Mexican region. The climate and geographical features of all are very similar; dry and barren plateaus and mountains, where little rain ever falls and where the heat in summer is very intense; with few streams to water the soil, and these few having an uncertain existence, the beds being nearly dry the greater part of the year. Cloud bursts, waterspouts and sand storms are characteristic of the whole country, and any division which can be made will place Upper Mexico, Arizona, New Mexico and Southern California in the same zoölogical and botanical region.

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EDITORS' TABLE.

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

—— The scope and aim of the biological sciences are embraced by their two great primary divisions, phylogeny and physiology. Phylogeny states the history and manner of the creation of beings possessed of life, while physiology exposes the forces which are active in creation and other functions of life, and sets forth their *modus operandi.*

All biological research contributes to one or the other of these departments. There are two branches essential to the development of phylogeny, viz: embryology and palæontology. The essential preliminary to both of these sciences is, of course, anatomy (including histology), or in other words, analysis of structure. A rational résumé of anatomy is taxonomy, or systematic zoölogy and botany. For the great department of physiology, knowledge of both physics and chemistry is necessary; and here the biological and physical sciences have their natural inosculation.

The student who is desirous of making a life-work of biological science, will often be at a loss to decide as to the best line of research for him to undertake. Circumstances of an incidental character generally determine his course for him. Such circumstance is the influence of a scientific friend; or the brilliant work of some able man who renders a department attractive. Fashion, which is seen in scientific as in other fields, will sometimes give the direction; but the most usual determining agent is the material for study which may lie most conveniently near the student's hand. Every department has its attractions, and nature presents to the appreciative intellect an *embarras des richesses*, in whatever direction it turns its view.

The science of physiology is the most difficult of prosecution, and has, on this account, made less progress than some of the other branches. Its results, having a direct practical bearing besides their scientific value, awaken greater popular interest than those in almost any other department. The successful physiologist will have many rewards, but his labors will often, like those of Sisyphus, be without satisfactory results.

The study of anatomy is open to all, and in an infinitude of directions. Every biologist must master as many of its details as are necessary as a foundation for a superstructure of one of the other branches. The pure anatomist who correctly portrays the mechanism of living machines, places all other biologists under obligations to him. But before the anatomist can proceed intelligently, he must have a preliminary idea of the character of the animal or plant he investigates. This is first determined by a consideration of the external anatomy of large numbers of species, which is the work of the systematic biologist. Of course the full expression of the relationships, as shown by the resemblances and differences of species, cannot be had until the whole anatomy is known. The first work of the taxonomist is therefore necessarily imperfect, and partly on this account it is the fashion in some quarters to speak lightly of his labors. It is, however, true that taxonomy cannot be done without;[1] also, that when the anatomy, as in the higher animals, develops a great many terms whose relations are to be properly expressed, it requires no mean order of intellect to solve the problem thus presented to it.

[1] Linnæus says (Philososophia Botanica, p. 202): "Botanicus tyro novit classes; candidatus omnia genera; magister plurimas species. Quo plures Botanicus noverit species, eo etiam præ-tantior est. Cognitione specierum innititur omnis solida eruditio physica, œconomica, medica; immo omnis vera cognitio humana."

Judging from results in this field, this kind of ability is not common, for the most admirable observers are frequently quite unable to appreciate the taxonomic bearings of the facts they have brought to light.

The sciences of palæontology and embryology contribute equally to a true phylogeny, which is already indicated by taxonomy. It is difficult to decide which of these departments is the more attractive. The naturalist who lives in a region where well preserved fossils are abundant, will not weary of exploring the horizons within his reach, and of tracing the structure and affinities of the forms he discovers. A few feet of rock will often separate faunæ more distinct in their characters than those which now inhabit the most widely separated regions of the earth. An expedition of a few miles will yield results of greater importance than the exploration of the fauna of entirely new regions of the earth's surface.

The disadvantages of this pursuit are the generally imperfect character of the remains of ancient life; and secondly, in the case of the vertebrate animals, the expense involved in obtaining them.

The student of embryology, like the anatomist, has his material on every hand. If he take the pains, he can observe the most wonderful phenomenon the world affords, the development of a complex being from a single cell. In the successive stages of growth he will trace the impress of ancient environments, and will read the outlines of the history of descent only less perfectly than the palæontologist. Although embryological study is possible everywhere, it involves much patient and laborious manipulation; more so than any other department, excepting physiology. Its rewards are, however, great.

In the outset of their career, naturalists are often perplexed as to the question of ways and means. To those who must seek a livelihood, two courses are open. One is the practice of medicine, which is a pursuit generally congenial to the biologist, and one which will at least sustain life, and permit of some leisure time for study. The other, and to our thinking preferable course, is the pursuit more distinctively that of the naturalist, teaching his favorite subject. He thus makes it his business, which shall support him. The number of colleges and universities in the United States is large, and is increasing. Each of these must have, sooner or later, a professor of natural sciences. The salaries will often be small, but the investigator desires time rather than money. The supposed necessity for a large income has extinguished many a promising biologist. So long as financial prosperity, rather than intellectual accomplishments and ability, gives position, this will continue to be the case. We hope and believe, however, that it will not be long before intellectual development will have so far progressed in America as to reverse this order of precedence in the estimation of the general public, and that it will give to the man who produces knowledge, the high position he has always held in the minds of the thoughtful of the human race.

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RECENT LITERATURE.

Tylor's Anthropology.[1]—It is only within some twenty years or a little over a generation, that under the enlarged mode of studying nature for which we are indebted to Darwin and others, as well as to German embryologists and histologists, particularly those who have worked from an evolutional point of view, that the science of biology has become well established. Modern physics has recently discovered the law of the conservation of force and other doctrines which have so enlarged the sphere of the physicist. Hand in hand with the genesis of biology went on the development and perfection of the nebular hypothesis, and the rise of a new school in geology, the uniformitarian; while at only a late date has the science of meteorology assumed a definite shape, and later still the science of comparative psychology and sociology. The youngest of the sciences, of which this book is an exposition, is a logical outcome of all the sciences bearing upon life and the physics of the earth, the residence of man. In the fullness of time there has arisen a science of man, or anthropology, the synthesis or flower of all the sciences. Such a science could not have come into existence were not the keystone of the arch supporting it the doctrine of evolution. Old-fashioned ethnologists could go on indefinitely, measuring skulls and classifying the races of mankind, archæologists could industriously unearth forgotten graveyards and buried cities, till every foot of soil on the globe had told its tale of dead dynasties and forgotten cities, but unless a working theory of development from the general to the special, from the crude and unfinished to the perfected; unless different and successive early stages were looked upon as initiatory, as only existing to give rise to something more composite, highly finished and enduring, we could not have had the science of anthropology.

It is from the point of view of progress and growth, of elaboration from simple beginnings, and the origin of the composite manners and customs of modern civilization from the aboriginal arts and habits of savage life, that the new science of anthropology is to be built up and perfected.

Just as the study of the embryology of Ascidians and of the Amphioxus has well nigh revolutionized our conceptions of the vertebrate type, and man's structure can only be understood by a

[1] *Tylor's Anthropology:* An introduction to the study of Man and Civilization. By Edward B. Tylor, D.C.L., F.R.S. With illustrations. New York: D. Appleton & Co., 1881. 8vo, pp. 448.

study of the lower invertebrate as well as vertebrate organisms, so our modern civilization can only be analyzed and clearly understood by reference to the social structures of savage life and the developmental steps by which the savage became a barbarian, and the barbarian threw aside the features of savagery, and after a series of changes, paralleled by the metamorphoses of the butterfly or starfish, assumed the advanced forms and environment of civilized life. Nay, a tolerably exact parallelism may be made between the premature civilization of certain races of mankind and those which more slowly and surely developed into modern and probably permanent types of civilization. The prematuritive type of pseudo-civilization of Peru and Mexico, of Babylon and Assyria, so strikingly suggestive of later and specialized types of civilized life, may be compared to the prematuritive, generalized, prophetic types of Silurian ganoids and Selachian fishes, which flourished as exceptionally perfect forms amid the multitudes of lower organisms about them, and which sank, as it were, and died under the weight of the ill-assorted and unequally perfected assemblage of organs composing their bodies. Anomalous and unintelligible would be the premature and comparatively short-lived pseudo-civilizations of the infancy of our race, were it not written in the rocks that the idea has been worked out again and again in palæozoic history.

Such reflections and considerations as these are provoked by any course of biological study, and by reading Herbert Spencer's writings on sociology and more particularly the modest and able work before us of Mr. Tylor. In the present book the science of anthropology has been, perhaps for the first time, reduced to coherent and intelligible shape. In a simple and yet masterly way the subject is outlined and put into the briefest form. The aim of the author has evidently been to simply sketch out a subject vast and intricate in its details.

We will now give a synopsis of the subject, to enable our readers to form a slight idea of what anthropology is, and it should be premised that the science has been largely built up and promoted by geologists and biologists, who established the fact of the high antiquity of man, which led them to investigate the habits and arts of the prehistoric races, and thus to utilize the results of ethnologists and archæologists, until the missing links between the prehistoric and historic races of mankind could be with tolerable certainty supplied.

Beginning with the fact that man may be divided into races rather than species, our author remarks that: "Altogether, the evidence of ancient monuments, geography and history goes to prove that the great race-divisions of mankind are of no recent growth, but were already settled before the beginning of the historical period. Since then their changes seem to have been comparatively slight, except in the forming of mixed races by intermarriage." These races, Tylor believes, have descended from a common ancestry, however distinct, while the different races, such as the black, brown, yellow and white, "are living records of the remote past, every Chinese and Negro bearing in his face evidence of the antiquity of man." So the study of philology shows that one family of languages, now spoken in Asia and Europe has descended from a common ancestral language, which is now theoretically called the Aryan, though "of an original primitive language, the most patient research has found no traces." Also when we consider the arts and customs of mankind, "it appears, says our author, "that whenever there are found elaborate arts, abstract knowledge, complex institutions, these are the results of gradual development from an earlier, simpler and ruder

FIG. 1.—South Australian (Man).

state of life. No stage of civilization comes into existence spontaneously, but grows or is developed out of the stage before it. This is the great principle which every scholar must lay firm hold of, if he intends to understand either the world he lives in or the history of the past."

After sketching what history, archæology and geology teach as to man's age and course on the earth, he considers man's place in the animal world, and maintains that man's intellectual development "must have been in no small degree gained by the use of his hands."

As to the distinctions between man and the apes, Tylor remarks that "whereas the lobes of the ape's brain has fewer and simpler convolutions than in the human brain," as regards the

the latter, "both size and complexity mean mind-power." He then attempts to answer the question, How far do their minds work like ours? and falls back on the power of speech as giving "about the clearest distinction that can be drawn between the action of mind in beast and man," and he thinks it safe to conclude that the "mental machinery of the lower animals is roughly similar to our own, up to a limit."

The author then discusses the races of mankind, and states what a race is. Perhaps the lowest are the Australian (Figs. 1, 2,) and also the Andaman islanders (Fig. 3), the latter thought, by Flower, to be a remnant of a very early human stock, perhaps the best representative of the primitive Negro type. Tylor regards the native American, from the Arctic regions to Patagonia, as constituting

FIG. 2.—South Australian (Woman).

a single race. He thinks it "probable that man had appeared there, as in the old world, in an earlier geological period than the present, so that the first kinship between the Mongols and the North American Indians may go back to a time when there was no ocean between them. What looks like later communication between the two continents is, that the stunted Eskimo, with their narrow roof-topped skulls, may be a branch of the Japanese stock, while there are signs of the comparatively civilized Mexicans and Peruvians having in some way received arts and ideas from Asiatic nations."

In the chapter on language; sign-writing, gesture language, sound-gestures or interjections, are regarded as steps leading to the origin of language, which form what Tylor calls natural language, which may be used by peoples of different spoken languages. As to the origin of language, it was not, in the author's view, "an event which took place long ago once for all, and then ceased entirely." "So far as language can be traced to its actual source, that source does not lie in some lost gifts or powers of man, but in a state of mind still acting, and not above the level of children and savages."

The act of writing is traced from the pictures of savage hunters to Egyptian hieroglyphics or pictures used to represent the sound of their name, then to the breaking down of the picture into a mere sound-sign, till the Phœnician alphabet arose from the Egyptian

FIG. 3.—Andaman Islanders.[1]

hieratic and the Greek alphabet from the Phœnician, which came down to us through the Romans. Then the origin of the arts of life, of pleasure, of the sciences, is discussed in a most suggestive way, and finally the notions of mankind concerning the spirit world, the origin of history and mythology, and lastly the origin of society. The author concludes "that the study of man and civilization is not only a matter of scientific interest, but at once passes into the practical business of life. We have in it the means of understanding our own lives and our place in the world, vaguely and imperfectly it is true, but at any rate more clearly than any former generation. The knowledge of man's course of

[1] The three wood-cuts kindly loaned by the publishers will give an idea of the excellence of the illustrations.

life, from the remote past to the present, will not only help us to forecast the future, but may guide us in our duty of leaving the world better than we found it."

Here our exposition of this able work must end; anthropologists may not agree with all of the author's conclusions; the science is in its infancy, and its center of gravity is not yet settled, but it must prove an invaluable manual of the subject. Few errors appear in it; a rather startling one is the author's statement on p. 30, that the musk ox "may still be hunted in the Rocky mountains with the grizzly bear." This is an evident slip of the pen.

KNOWLEDGE[1].—Under this title comes to us the first number of a popular scientific magazine. We welcome as many such journals as there is room for; whether there is for this one, time will show. Judging from the first number, "*Knowledge*," will be more than usually popular. We can anticipate that the department of astronomy will be very well conducted. There are several valuable articles, *e. g.*, "On science and Religion," by the editor, of a mediatory character, and one on The Relation of Food to Muscular Work, by Dr. Carpenter; also one on Illusions, by Thomas Foster, and a review of Darwin on Earth Worms. Of less value is a review of Delaunay's paper on the relative characteristics of men and women, which from the style of its logic, appears to have been written by one of the sex it seeks to defend from Dr. Delaunay's definitions. We hope for *Knowledge* a large share of usefulness and patronage.

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[1] *Knowledge.*—An Illustrated Magazine of Science. Plainly worded, exactly described. Conducted by R. A. PROCTER, B.A. Wyman & Sons, 745 Great Queen Street, London.

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GENERAL NOTES.

BOTANY.[1]

DIMORPHISM IN BLACK MUSTARD.—It may not be generally known that there are two forms of flowers in the common mustard (*Brassica nigra*), which differ mainly in the length of the pistil. In the short-styled form, the top of the stigma does not quite reach to the bases of the higher anthers, and is about even with the tips of the lower ones. The long-styled has the stigma reaching to the middle of the higher anthers. The dimensions of the stamens are nearly identical in the two forms.

In each flower, they may be naturally divided into two sets, each set consisting of two long stamens and one short. Those of the same set face toward each other, that is, toward the nectary of the set, which is surrounded by them and the pistil. There are two nectaries, therefore in each flower, and on opposite sides of the pistil. Two advantages of this arrangement should be mentioned: first, the anthers near the pistil turn away from it, so that their pollen does not easily reach it, but rather the bill of the insect which reaches down to the nectary, and second, as the

[1]Edited by PROF. C. E. BESSEY, Ames, Iowa.

insect passes from one nectary to the other, its bill is likely to carry pollen to the stigma.

As in other cases of dimorphism, all flowers on the same root have the same form. Much care should be taken in verifying this statement, for, as in both forms the pistil soon elongates, after the flower has passed its prime, it is easy to mistake older flowers of the short-styled form for long-styled ones. But comparing flowers which have just opened, or before they have been fertilized, the facts stated above will be clearly seen. The styles in the two forms differ in length a little less than one millimetre.

The dimorphism in this case seems to be imperfect. There are two lengths of stamens, and two lengths of pistils to correspond, but while the different pistils are distributed to different plants just as in Houstonia, Lithospermum, etc., the different stamens are not even distributed to different flowers. Moreover, the longer stamens are twice as numerous as the shorter. These facts suggest the following queries:

1. May we not have in this case two plans for cross-fertilization coëxisting, viz., one more or less analogous to other cases of heterostylism, and the other like that in the Rosaceæ, etc., where stamens and pistils are equally prominent, to profit by the haphazard movements of insects visiting the flowers?

2. Do similar relations exist, in all the Cruciferæ, or are these variations which indicate a transition stage in the development of dimorphism?

To direct observation and obtain an answer, especially to the latter question, has been one purpose in publishing the facts given above.—*J. E. Todd, Tabor, Iowa.*

Motion of the Fruit of Tilia while in the Air.—Every one is familiar with the singular inflorescence of the genus *Tilia*, in which the long peduncle, really axillary to the large papery bract, is so adnate to this for about half its length, as to appear to spring from its middle. Well known as are these lindens or limes, and especially the *Tilia Europæa*, I do not recall having seen any mention of the use that the plant makes of this scale in distributing its fruit. As the globular nuts ripen, the scale becomes more dry and papery. It also bends back upon itself from the point where the peduncle becomes free. It is weighted, as it were, by the fruit balls below. Sometimes moreover, there is a lateral twist to the wing, making it not unlike the fluke of a propeller. Now, when a breeze disengages this apparatus, it falls by its own weight, but, through the influence of the wing, at once begins to revolve rapidly upon its axis, looking like the governor of a steam-engine in rapid motion. I take it there is here a chance for mathematical research, but that is unfortunately out of my line. Will not some botanist of a mechanical turn, if such a being exists, study into this matter a little? I take it that the purpose of the apparatus is, as in the case of the ash, to propel the fruit outside of the immediate radius of the tree. So like butterflies do these scale-borne nuts in the air appear, that I have been repeatedly deceived by them. It seems to me that the subject would reward the diligent study of one who combined good powers of observation with certain mathematical attainments.

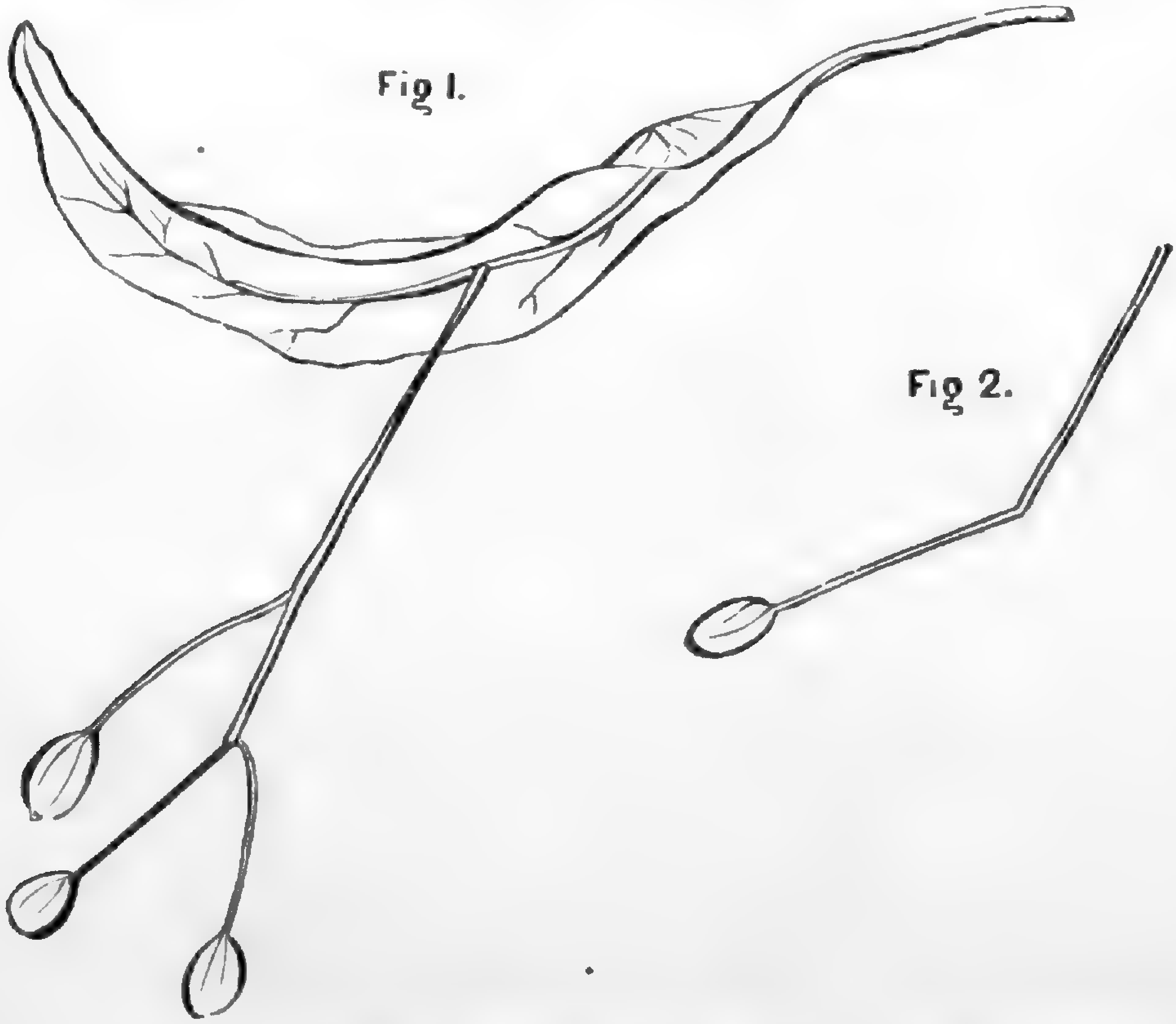

FIG. 1.—Bract, with its cluster of ripened nuts; FIG. 2.—A more frequent condition.

I would add that usually, the nuts more or less break off before the disarticulation of the scale from the tree, one or two only remaining, and these standing somewhat at right angles to the main peduncle. May not this throwing of the weight to one side, itself induce the revolution?—*W. W. Bailey, Brown University, Oct. 15, 1881.*

THE SENSITIVENESS OF TENDRILS.—Some years since, in order to measure the sensitiveness of the very fine and slender tendrils of *Cobæa scandens*, I placed one evening at seven o'clock, a human hair about two inches in length upon an expanded tendril. This was done with the greatest care, so as not to produce any other irritation than that due to the weight of the hair itself. Upon examination the next morning at seven o'clock, the tendril was found to have tightly clasped around the hair, and coiled itself into a tight knot. Every precaution had been taken to prevent interference with the experiment, so that it may be considered as certain that the contact of the hair was the exciting cause of the twining of the tendril.

THE SUPERABUNDANCE OF POLLEN IN INDIAN CORN.—Nature evidently intends to secure the fertilization of the young ovules in the Indian Corn (*Zea Mais*) beyond all chance of failure. In the autumn of 1875, I made a large number of careful counts and estimates which resulted in fixing upon twenty-five hundred as the average number of pollen grains in each anther. Each panicle of male flowers (the "tassel") was found by careful estimates, to contain about 7200 stamens, so that the number of pollen grains produced by each plant is about eighteen millions. Allowing two ears of one thousand kernels each, to each plant (a very high estimate), there are still nine thousand pollen grains for every ovule to be fertilized!

THE COMMON NAMES OF OUR PLANTS.—An effort is now making to collect and arrange the common names now borne by the plants of the United States, somewhat as has been done for English plants by Prior in his "Popular Names of British Plants," and Messrs. Britten and Holland, in the "Dictionary of English Plant Names." Whatever may be said against common names on account of their frequently objectionable form, their common application to several entirely different plants, besides other objectionable features, not to mention their little value to the practical botanist, it yet remains that plants are known to a very large portion of our people by common names only. We must confess to a rather kindly feeling for these popular names, in spite of their many faults and sometimes exasperating inconstancy and inconsistency, and so we hail, with delight the announcement made by W. R. Gerard, one of the editors of the *Torrey Bulletin*, of his intention to undertake to record the names under which the same plants are known in different parts of the country. As this is a movement in the right direction, undertaken by one eminently qualified to complete it, we have no hesitation in urging readers of the NATURALIST, to render aid "by collecting lists of the popular names by which our plants are known in their neighborhoods," and sending them to Mr. Gerard (9 Waverly Place, New York City), accompanied of course by the scientific equivalents. It is known that many of the so-called common names given in the books are merely book-names, having no usage except in botanical classes in schools, and with those whose knowledge of plants is derived mainly from books; it is desirable that such be carefully distinguished from those in use by people who have no knowledge of the botany of the books. The names given to plants by the Indians, are also of interest, and should be preserved.

COREOPSIS ROSEA.—In Gray's Manual of Botany, *Coreopsis rosea* Nutt. is marked rare, and credited to Plymouth, Mass. It occurs abundantly on the sandy, wet shore of Waushakum pond, South Framingham, Mass., and it has also been found by Dr. E. A. Daniels, Medway, on the shores of Kingsbury's pond. The receptacle is distinctly conical, and as my 1859 edition of Gray says, under the generic title, "receptacle flat," I must acknowledge the kindness of Dr. Daniels, in identifying the plant from Nuttall's description.—*E. Lewis Sturtevant, South Framingham, Mass., Oct. 19, 1881.*

CERATOPHYLLUM DEMERSUM IN FRUIT.—Gray, in his Manual, says that *Ceratophyllum demersum* L. is "common but rarely seen in fruit." I have to-day the pleasure of finding the plant in this somewhat uncommon condition.—*Dr. Alfred C. Stokes, Trenton, Aug. 30, 1881.*

BOTANICAL NOTES.—The opening address before the Geographical Section of the British Association for the Advancement of Science, was given this year, by Dr. J. D. Hooker. Very naturally the address was principally concerned with the geographical distribution of plants, which was reviewed historically.——T. R. A. Briggs calls attention, in the *Journal of Botany*, to the fact, that hybrids occur between some of the species of *Epilobium*, and describes one between *E. hirsutum* and *E. montanum*. Have our species been observed to hybridize?——De Bary is publishing in the current numbers of the *Botanische Zeitung*, an important paper, on the *Peronosporeæ*. If possible a summary will be given in these columns before long.——The "Catalogue of the Plants of Indiana," which has been publishing in parts as extra sheets in the *Botanical Gazette*, has appeared in pamphlet form. In all there are recorded 1432 species of flowering plants and vascular cryptogams. Valuable notes are appended to many of the species. The "characteristic forest trees are the poplar *(Liriodendron)*, maple, ash, elm, black and white walnuts, oak, hickory, beach, sycamore." The authors (Professors, J. M. and M. S. Coulter, and C. R. Barnes) further state in their preface that "the flora of the State is readily divided into four groups, each marked by the physical aspect of the region in which it is found; these regions may be called (1) 'the river valleys,' (2) 'the lake borders,' (3) 'the prairies,' and (4) 'the barrens'."——Brefeld's recent studies of Entomophthoræ, lead him to regard them as constituting a small family closely allied to the Ustilagineæ, or possibly through *Entyloma*, merging into the latter. As the Entomophthoræ are clearly oösporous in their sexual reproduction, Brefeld must consider the spores of Ustilagineæ as actually oospores, modified and degraded by excessive parasitism. This would bring the Peronosporeæ, Saprolegniaceæ, Entomopthoræ and Ustilagineæ into a series of allied orders, and would separate quite widely the last named order from the Uredineæ, heretofore usually associated with them.——The reviews of Pfeffer's new book on the Physiology of Plants *(Pflanzenphysiologie,* Ein Handbuch des Stoffwechsels und Kraftwechsels in der Pflanze. Band I. Leipsig, 1881) indicate that when completed, it will be a most valuable acquisition to the literature of this department of botany. Why cannot some of our publishers secure the translation of this work?——The late Professor Parlatore, before his death, had planned a work on the Comparative Anatomy of Aquatic Plants, which unfortunately was left unfinished. The fragmentary work consisting of nine fine plates showing figures of cross and longitudinal sections of different organs, together with explanatory text, has been published in Florence under the title of *Tavole per una "Anatomia della piante acquatiche."* Species of *Alisma*, *Callitriche*, *Ceratophyllum*, *Hippuris*, *Myriophyllum*, *Naias*, *Nelumbium*, *Nuphar*, *Nymphæa*, *Potamogeton*, *Trapa*, *Vallisneria*. *Victoria*, and many other phanerogams, and of *Iseries*, *Marsilia* and *Pilularia* among vascular cryptogams, are included in the figures.——Dr. Karl Kraus' observations upon the flow of sap from cut surfaces of plants, promise when completed, to throw light upon the poorly understood subject of the movement of fluids in plants. The sieve tissue of the fibrovascular bundle appears to conduct fluids most abundantly, although other tissues can act as conductors, as the fibrous envelope of some bundles, and the immature trachery tissue of others. Even collenchyma may serve as a conducting tissue. Mature vessels (tracheary) conduct no sap, and parenchyma does so only when sap is exceedingly abundant.

ZOÖLOGY.

THE CŒLOMA THEORY.—Since Haeckel's publication of his Gastræa theory, the most important generalization in embryology is the Cœloma theory of the brothers Hertwig.[1] It is an expression of the history of the nature and changes of the middle layer of the blastoderm.

They define two types of middle layer as follows: In the first, it is formed of separate cells which wander from the epiblast and hypoblast, which in some instances appear round the mouth of the gastrula. This they call the *mesenchym*. In the second type, the layer is divided as two strata of cells from the epiblast. To this form they restrict the name *mesoblast*. Moreover in the animals which present the mesenchym, there is a cavity between the epiblast and hypoblast, which is not the true body-cavity. Such are the Plathelminths (flat worms) Bryozoa and Mollusca. To this series they give the name of *Pseudocœlia*. The echinoderms, brachiopods, round worms, arthropods and vertebrates possess a mesoblast. Here the two layers of the mesoblast separate and form the walls of the body cavity, which is divided by the intestine into two chambers. To this division is given the name of the *Enterocœlia*. Animals are thus divided into two divisions, those in which the blastoderm consists of two layers, and those in which it is formed of four layers.

The consequences of these modes of origin are seen in charac-

[1] Jenaische Medicinische Zeitung. 1881.

teristic structures of the adult. Thus in the *Mollusca* the vessels of the circulatory system are diverticula of the general body-cavity with which they freely communicate. On the other hand the circulating vessels of the *Enterocœla* never communicate with the body-cavity, but originate from the digestive system, or independently. In the *Pseudocœlia* the nervous system is derived from the mesenchym, except perhaps the supraœsophageal ganglia of Mollusca. In the *Enterocœla*, on the other hand, the central system is developed from the epiblast, and the peripheral system from the epiblast and external layer of the mesoblast.

THE TORTOISES OF TUCSON.—There are two land tortoises and a fresh-water turtle found here that are not given in the list of reptiles for Southern California, by Dunn and Fisher, published in the April number of AMERICAN NATURALIST.

One of the terrestrial tortoises[1] resembles at first glance the common box tortoises, *Cistudo virginiana*, but differs in the ornamentation of the plates on the carapax and on the sternum. The whole exoskeleton is marked with brown and yellow stripes and spots; brown predominating on the carapax and yellow on the sternum.

The only specimen in my possession I found crossing the road seventy miles south of Tucson, in Pima county, Arizona, some distance from permanent water. My specimen is five and a-half inches long, four inches broad and two and three-quarters inches high.

The other land tortoise is a large animal.[2] This fellow is found on the basaltic mountains in the most arid parts of this dry country. He is a vegetarian, feeding, as I am told, on cacti. His flesh is highly esteemed as food by the Indians and Mexicans. You will perceive that his mandibles are notched or toothed. His legs are covered with bony scales, and his front toe nails are made long and strong for digging amongst the rocks, while the hind feet are round like an elephant's.

When molested he draws in his head and closes the aperture with his legs by bringing the knees together in front of the head; the hind legs are also drawn in until the posterior spaces are closed by the feet, and in this way all vulnerable parts are protected by impenetrable armor. In preparing the specimen, I found on each side, between the flesh and carapax, a large membranous sack filled with clear water; I judged that about a pint run out, though the animal had been some days in captivity and without water before coming into my possession. Here then is the secret of his living in such a dry region; he carries his supply of water in two tanks. The thirsty traveler, falling in with one of these tortoises and aware of this fact, need have no fear of dying for immediate want of water.

[1] *Cistudo ornata* Agass.

[2] *Xerobates agassizi* Cooper.

The fresh-water turtle[1] is found in the Santa Cruz river at Tucson. This is a small stream about twenty feet wide at low water; it rises in Arizona, on the east side of Patagonia mountains, flows southerly into Sonora, Mexico, then turns northward and again enters Arizona between the Santa Rita and Oro Blanco mountains. The water sinks beneath the surface for the greater part of its course, except in the rainy season, and is only a flowing stream for a short distance at this place, and is supposed to empty into the Gila river, near Maricopa wells.—*E. T. Cox.*

Intelligence of a Cat—Several years ago my grandfather moved from his farm into this city. Among the domestic animals on the place at that time was an old cat with one small kitten. These they intended to leave, placing the kitten in a room where a broken pane of glass would allow the cat to pass back and forth at will. The last load was nearly ready to start, when my father, who was making some final preparations, was attracted by an exclamation of surprise from his mother, and looking around he beheld the cat strutting along with the kitten dangling from her mouth. Without any interference on the part of the ladies, who were on the wagon, or by any member of the family, she marched directly to the load, and after surveying it a moment, jumped upon it, where, after a short search, she chose an inverted table and placed her charge in it. It is, perhaps, unnecessary to add that she was not left at the farm.

This story has a double charm for me. In the first place I know it to be true; secondly, it shows remarkable intelligence in the subject of it. We all know how watchful a cat is of her kittens and how eager she is to carry them back when removed from their bed, so it seems altogether out of the usual course when one, of her own accord, removes, as this one did, knowing undoubtedly that they were to be taken away.—*N. H. Hurd.*

Migration of Birds.—One of the most interesting reports presented to the last meeting of the British Association, was that of the committee on the migration of birds. Observations have been received from 103 lighthouses and lightships, which show that the migration of one species of birds or another is almost continually going on; but the great migrations are in the autumn and spring. From the facts gathered at lighthouses and lightships, it appears certain that many thousands of birds must perish at sea. The white fixed lights attract the greater number of birds, the mortality at Skerryvore for October, 1877, amounting to no fewer than 600, chiefly, the common thrush and the ring-ousel. Revolving lights are also fatally attractive, for at the Casquets, during the four hours from 11 P. M. to 3 A. M., October 7, with the wind S.S.E. and rain, land-rails, water-rails, woodcocks, ring-ousels, song

[1] A species of Cinosternum.—*Ed.*

thrushes, and swallows, were seen around the light, and of these there struck the glass and killed themselves, one land-rail, one water-rail, four ring-ousels, and no fewer than 100 swallows. The larger birds do not often strike the glass in the revolving lights, but follow the rays. So far the observations show that all birds, with few exceptions, are migatory—even sparrows, which invariably leave Heligoland before the end of September.

SUDDEN INTEREST IN JAPANESE ORNITHOLOGY.—In the report of some difficulties encountered by a well known library in New York, in their efforts to meet the public taste, we find a reference to an ornithological work which is as new to us as the reported interest in that science is surprising. The *Herald* says:

"President P. said that the management has spent three dollars for standard works to every dollar that has been expended on novels. The demand for the 'Birds of Japan' was so great that the directors had to buy sixty copies; and for other costly works the demand exceeded the directors' ability."

Perhaps one of the readers of "Unbeaten Tracks" may give us the means of properly classifying the ornithological specimen referred to.—*W. H. Dall.*

ASILUS AND LIBELLULA.—So far as I am aware, robber-flies are not credited with capturing prey larger than themselves. But last August my attention was attracted, one day, by a medium sized dragon-fly fluttering on the ground, and looking closely I saw a robber-fly, about three-fourths of an inch in length, quietly clinging to his body just under the right fore-wing, and sucking his blood. Haste forbade my waiting for the end of the struggle, but the issue was not uncertain.—*J. E. Todd, Tabor College, Iowa.*

TERNS AS FLY-CATCHERS.—Last August, near Fort Sisseton, D. T., I noticed many black gulls (*Hydrocheilodon lariformis*) in the air catching dragon-flies. They appeared to catch them by their tails, and after several pinches with the bill, with a raise of the head they gulped them down. All this was done very gracefully, while they were on the wing.—*J. E. Todd.*

SPECIMENS OF MELANTHO WANTED.—Sets of from five to ten specimens each, of all the species of the genus Melantho, from every available locality. Please correspond with R. Ellsworth Call, 1722½ Woodland avenue, Des Moines, Iowa. Liberal exchanges will be given in Strepomatidæ or Unionidæ. Material is wanted *at once*. Any specimens with the animal either dried or in alcohol especially desired.

ZOOLOGICAL NOTES.—Some of the causes affecting the decrease in the number of our birds are discussed by Mr. H. W. Henshaw, in the Bulletin of the Nuttall Ornithological Club for October. Besides the effects of disease, accident, the attacks of other animals, which probably act as but a slight check in the increase of birds, Mr. Henshaw mentions telegraph wires, and storms, the effects of which are pretty well known. Foggy and tempestuous weather, during which birds are dashed against lighthouses or are carried out to sea and drowned, cause widespread destruction among birds, and this occurs on the great lakes as well as on the ocean, and Mr Henshaw concludes that the "ocean's victims annually reach such figures as to affect the numerical relation of species over extensive areas."——In the same journal, Dr. Shufeldt records the discovery of a supposed new bone in the wing of a hawk (*Circus hudsonius*) which he calls the *os prominens*, but would not consider as a carpal bone.——A supposed new boring Annelid found injuring the iron wire of a submarine cable off Singapore, is described and figured by C. Stewart, in the Journal of the Royal Microscopical Society, for October.——The vinegar worm (*Anguillula aceti*) and its allies have been treated monographically, by Dr. L. Oerley; to show how little these animals need a special respiratory apparatus, a number of the vinegar worms were placed in a vessel and covered by a layer of oil an inch thick; after two months the greater number were still alive.——The development of the liver fluke has been studied by Mr. A. P. Thomas, who states that the embryo can only develop at a temperature lower than that of the mammalian body. The number of eggs produced by a single fluke "may be safely estimated at several hundred thousand."——The sea-urchins are being, in part, revised by F. J. Bell, in the Proceedings of the Zoological Society of London.——The one-celled animals, or Infusoria, especially, have been examined by C. Robin, to see whether the notion of a cell is sufficient to include everything in both elementary anatomy and physiology, and thinks that one-celled organisms "possess other things than those which occur under the form of cells." For example, *Podophrya lyngbyei*, in the larval stage, is a good example of both an anatomical and physiological unit. But it is certain that by virtue of their peduncle, of their theca which is separable from it, and of the body, which is separable from the theca, the adults of Podophyra, and the Acinetæ, in general, are Protozoa in which are found at least two kinds of anatomical and physiological units, the one of these, namely the non-contractile theca and its peduncle, is subordinate to the others, the sarcode body, and it remains essentially different from it in anatomical and physiological characters.——A very full account of the Protozoa inhabiting man is given by Leuckart, in the second edition of his work on human parasites. He regards the psorosperms as constituting a new class, which he calls *Sporozoa*. Grassi, in an Italian journal, also enumerates the Protozoa found by him, chiefly in man. The list is sufficiently formidable.——Mr. Darwin's book on the earth-worm, shows what a vast work is done by worms in altering vegetable into what he calls "animal mould." He also shows that worms are sensitive to light, to vibrations of any solid object with which they may be in contact, that they can smell natural food, have a sense of taste for food, but that the sense of touch is most highly developed. Worms are omnivorous, eating meat as well as leaves. How great quantities of leaves they drag under the ground, and how they undermine stones, and triturate in their stomachs small particles of stone, and thus act as geological agents is shown in this remarkable book.

ENTOMOLOGY.[1]

Retarded Development in Insects.[2] — In this paper the author records several interesting cases of retarded development in insects, whether as summer coma or dormancy of a certain portion of a given brood of caterpillars, the belated issuing of certain imagines from the pupa or the deferred hatching of eggs. One of the most remarkable cases of this last to which he calls attention, is the hatching this year of the eggs of the Rocky Mountain locust, or western grasshopper (*Caloptenus spretus*) that were laid, in 1876, around the Agricultural College at Manhattan, Kans. These eggs were buried some ten inches below the surface in the fall of 1876, in grading the ground around the chemical laboratory. The superincumbent material was clay, old mortar and bits of stone, and a plank sidewalk was laid above all. In removing and regrading the soil last spring, Mr. J. D. Graham noticed that the eggs looked sound and fresh, and they readily hatched upon exposure to normal influences, the species being determined by Professor Riley from specimens submitted by Mr. Graham. Remarkable as the facts are, there can be no question as to their accuracy, so that the eggs actually remained unhatched during nearly four years and a half, or four years longer than is their wont, and this suggests the significant question: How much longer could the eggs of this species, under favoring conditions of dryness and reduced temperature, retain their vitality and power of hatching?

Putting all the facts together, Mr. Riley concludes that we are, as yet, unable to offer any very satisfactory explanation, based on experiment, of the causes which induce exceptional retardation in development among insects. It is a very general rule that a rising temperature stimulates and accelerates growth, while a falling temperature retards and torpifies, and experiments recorded by the author[3] show that such is the case with regard to the eggs of *Caloptenus spretus*. But there are many strange exceptions to the rule. The eggs of crustaceans, as Apus and Cypris, are known to have the power of resisting drouth for six, ten or more years without losing vitality, while in some

[1] This department is edited by Prof. C. V. Riley, Washington, D. C., to whom communications, books for notice, etc., should be sent.

[2] Abstract of a paper read before the Entomological Section of the A. A. A. S. at Cincinnati.

[3] 9th Rep. Ins. Mo.; also 1st Rep. U. S. Ent. Com.

cases they seem actually to require a certain amount of desiccation before they will hatch. Yet the fact remains that different species act differently in this respect. In short, nothing is more patent to the observing naturalist than that species, and even individuals of the same species, or the progeny of one and the same individual act very differently under like external conditions of existence; or in other words, that temperature, moisture, food, etc., influence them differently. Hence—as has been shown by Semper to be the case with other animals, so it is with insects—changes in the external conditions of existence will not affect the fauna as a whole equally, but will act on individuals. We can understand how this great latitude in susceptibility to like conditions may and does in the case of exceptional seasons prove beneficial to the species by preserving the exceptional individuals that display the power to resist the unusual change, but we shall find ourselves baffled when we come to seek a demonstrable explanation of the cause or causes of such retardation, while the principles of evolution afford us the only hypothetical one at all satisfactory.

In the innate property of organism to vary and in the complex phenomena of heredity, we get a glimpse at the cause—a partial explanation—of the facts of retarded development, for the exceptional tendency in the present may be looked upon as a manifestation, through atavism, of traits which in the past had been more commonly possessed and more essential to the species. This hypothesis is strengthened by the fact that the period of two, three or more years occupied in full development by exceptional individuals of a species which normally goes through its transformations within one year, is at the present day the normal period in other species belonging to the same natural order.

Preparation of Diptera.—Prof. Joseph Mik, of Vienna, has, in the *Verhandlungen der K. K. zoologisch-botanischen gesellschaft in Wien* for 1880 (reprinted in Katter's Entomologische Nachrichten, 1881, pp. 189–206) an elaborate article on the Preparation of Diptera for cabinets, and we recommend a perusal of it to our dipterists, whether beginners or advanced students. It is evident from the paper that the proper preparation of Diptera for a cabinet, so as to render the specimens fit for scientific determination and study, requires more care and delicate manipulation than in any other order of insects. It is an art which can only be acquired by long practice, and we are glad that Professor Mik gives us the benefit of his life-long experience.

The Permanent Subsection of Entomology at the recent meeting of the A. A. A. S.[1]—Mr. Lintner's paper "on a remarkable invasion of Northern New York, by a Pyralid insect," gave a full and detailed account of the occurrence, to an injurious ex-

[1] Concluded from p. 902.

tent, in various counties of New York, of the larva of *Crambus vulgivagellus*, reciting the facts that have already appeared in our columns, in reference to this species and *Nephelodes violans*, but giving, in addition, very careful records of observations as to the habits of the former. On an island on the Roquette river, which had been absolutely denuded of grass, the worms had so thickly congregated under the shade of a solitary oak tree, that its base for about 18 inches was covered with a fine layer of silken web. The worms had evidently been forced, from sheer lack of food and shade, to migrate, and they naturally congregated under the first shade in their way, constantly spinning, as is their nature, until the compact web was formed. The term "invasion" as applied to the exceptional increase of this species seems to us unfortunate and to convey a wrong impression.

Mr. Edwards's paper "on an alleged abnormal peculiarity in the history of *Argynnis myrina*," gave a number of facts from his own observations, which go to show that the history of this species, as well as that of *bellona*, as related by Mr. Scudder, in his recent work, was quite incorrect.

Mr. Cook, in his paper "on carbolic acid as a preventive of insect ravages," gave his experience with carbolic acid as an insecticide. By mixing two quarts of soft soap with two gallons of water, and adding one pint of carbolic acid in the crude state, and then diluting one part of this mixture to fifty parts of water, he found that he could protect his radishes from maggots, the flies being thereby kept away from them. He made the application once a week. He also found carbolic acid a good substitute for soft soap in protecting his apple orchard from borers. He gave further experiments to show the value of London purple as a preventive of the work of the apple-worm. In the discussion of this paper, Mr. Riley expressed his belief in the efficacy of London purple, for this purpose, but objected, on general principles, to its use on fruits, and particularly on the more mature apples as against the second brood of worms. He believed that knowledge of its use, would prejudice purchasers. Mr. Claypole coincided with these view. Mr. Cook argued that the danger was more imaginary than real, and cited several cases, where it had been extensively used with great benefit, and no ill results.

Mr. Claypole's paper on *Sericoris instrutana*, gave an interesting experience with the insect, showing how its larva destroys the leaf stem of the buckeye. In the vicinity of Yellow Springs, Ohio, it is a common annual occurrence that shortly after the leaves of the buckeye *(Æsculus glabra)* have unfolded in the spring, many of the leaves begin to droop and wither, and become conspicuous enough to catch the eye of ordinary observers. This results from the work of the larva of the Sericoris, which after burrowing in the leaf-stem lives in the faded and rolled-up leaf. Mr. Claypole's observations indicate but one annual brood, as no trace of injury is observable after the beginning of May. The work of this insect is exactly like that of *Proteoteras æsculana* Riley, on maple and buckeye, but as Mr. Claypole's specimens were determined by Professor Fernald, there can be no doubt about the species, notwithstanding *instrutana* is known to feed also on clover. The food-habit in the species is thus as diverse as it is, for instance, in *Psylla tripunctata* (in Homoptera), which breeds alike on the tips of Pinus and in the crimped leaves of Rubus.

In his paper on Syrian bees, Mr. Cook told how D. A. Jones, of Canada, and Frank Benton, of Michigan, went to Europe in search of new varieties of bees. They brought from Larnaca, Cyprus, both the Cyprian bee and the Syrian bee, and Mr. Benton went to Ceylon and Java, in search of other varieties. From the former place he brought two new species, *Apis dorsata* and *A. floreæ*, the former making immense combs exposed to the underside of branches, the latter a delicate and beautiful comb in the hollows of trees and rocks. In Java he failed to find "the great Java bee." With the Syrian bee, Mr. Cook has Syrianized the apiaries of the Michigan Agricultural College. The Syrians are of yellow type, closely allied to the Italian bee, which latter is probably a modified offspring of the Cyprians, which, in their turn, are also probable descendants of the Syrians. The Syrian bees are indefatigable workers, no matter what the clime to which they are exposed, or the season of the year. They are more irritable than other bees, especially when queenless, but Mr. Cook believes they are a great acquisition to American apiculture.

Mr. Mann's communication on "suggestions of coöperations in furthering the study of entomology," contained some remarks suggestive of the title and urging the foundation of libraries and indices to the contents of periodicals and society transactions, but was mainly a plea for the support of the Cambridge Entomological Club, and the organ of the club, *Psyche*. He set forth one aim of the club, which is worthy of commendation. Recognizing the difficulty which numerous students, and intending students of entomology in this country, find in purchasing for their own use the books they need, the club has decided to make of its library, as far as practicable, a national loan library of entomology, for which members of the club, and other persons showing a sufficient interest in entomology, should be entitled to borrow books, at the least possible cost to themselves. The effective carrying out of this plan, has, thus far, been greatly hampered by the very limited resources at the disposal of the club, and it was for assistance that the speaker made his appeal. If the *Psyche* drags, or fails to fulfill its original mission, the cause may be found in the fact, that since it was started, much more thorough bibliographic serials, like the *Zoologische Anzeiger* and *Zoologische Jahresbericht* have appeared. It is certainly not for want of zeal on Mr.

Mann's part. He severely (and in our opinion, unjustly) criticized the managers of the American Entomological Society in Philadelphia, but we fear that no amount of criticism of other institutions, will make of the Cambridge Club the national institution Mr. Mann would desire, for the elements of nationality have so far been lacking.

Mr. Cook's paper entitled "How the Bee extends its tongue" was an illustration by means of diagrams of the manner in which the mouth-parts are first straightened by muscular action, and the ligula then protruded by the injection of liquids from ramose glands situated in the head and thorax.

Of Mr. Riley's papers, an abstract is given in this number of that on retarded development, and we hope to give abstracts of the others shortly.

ANOTHER HERBIVOROUS GROUND-BEETLE.—Complaint is made in Californian agricultural papers of the damage done to strawberry plants by a Carabid beetle. The beetle has been determined, by Mr. J. J. Rivers, curator of the University Museum, Berkeley, Cal., as *Anisodactylus confusus*. If this determination and the observations be correct, we shall have to add another Carabid to the list of species injurious to vegetation. We may remark here, by the way, that already in the Agricultural Report for 1868, Professor Glover records that *Harpalus caliginosus* had been taken in great numbers under wheat stacks in Maryland, and in open fields on timothy grass apparently feeding on the seeds.

A DISASTROUS SHEEP PARASITE.—Reports come to us of great injury to flocks in parts of Illinois by a parasite that is new to sheep raisers in that region. We have not yet seen specimens, but from the accounts and descriptions given, it is evidently what is known as the red-headed sheep louse (*Trichodectes ovis*). Mr. Daniel Kelly, of Wheaton, Illinois, an old time correspondent, found that by dipping the sheep in a wash made by Little's Chemical Dip, the animals were freed from the pest.

PHYLLOXERA NOT AT THE CAPE.—The commission appointed to inquire into vine diseases have concluded their labors and embodied their researches in a valuable and voluminous report. The commission are, however, anxious to say that their work is not yet completed, and that the present report is published mainly to satisfy the public mind on the question of the Phylloxera. Having heard positively that the Phylloxera existed on certain farms, the commission at once visited those places, and after painstaking examination have come to the conclusion that this disease does not exist in any of the places stated to contain it, nor have they discovered it on any of the farms they visited. In order to confirm their judgment they sent home through the instrumentality of the Government, specimens of rootlets, leaves and parts of the vines to Dr. Cornu, who is admittedly the first authority on the subject in Europe, and his opinion confirms the views of the commission in the amplest manner. Dr. Cornu says: "I made the most minute and careful survey of the vines said to be so affected, and came to the decided conviction that the Phylloxera did not exist on the vines in question."—*Eastern Province Herald, Port Elizabeth, Cape of Good Hope.*

RESISTANCE OF GRAPE-VINES TO PHYLLOXERA IN SANDY SOIL.—The immunity from the attacks of Phylloxera enjoyed by grape-vines when planted in sandy soil has long been known, and has been attributed to various causes. M. Saint-André, of Montpellier, France, discusses this subject in the *Messager Agricole* for May 10, 1881, and believes that neither the mobility nor the angulosity of the particles of sand, nor the absence of cavities, nor the chemical composition of sandy soil are sufficient reasons. Nor is the presence of a subterranean current of water in sandy soil an admissible reason, since it has been proven that the quantity of water contained in such soils at different depths and at different seasons is always smaller than that contained at the same period in other soils where the presence of Phylloxera renders the culture of the grape-vine impossible. He believes, however, that the circulation of water in the soil is a matter of the first importance in regard to the presence of Phylloxera, and that there exists a close relation between the resisting power of the vines and the capillary capacity of the soil. By this latter term he means the quantity of water which can be mechanically retained by a soil completely saturated with it. Where this capillary capacity of the soil is very small, the grape-vine enjoys absolute immunity from Phylloxera attacks; the more it increases the more the plants suffer. Sandy soil was found to possess the smallest capillary capacity, varying from 23 to 35.80 per cent., and in such soil the grape-vines are not only never attacked by Phylloxera, but the insect even disappears from infested plants when these are transplanted to such soils. Where the capillary capacity is above 40 per cent., the vineyards in France are rapidly disappearing under the attacks of the insect. Between the two limits above given, the plants suffer more or less. Exact figures cannot be given, as much depends on the resisting power of the different varieties of grape-vines and on the mode of cultivation. American resisting vines can be successfully cultivated in soils the capillary capacity of which attains, and even surpasses 45 per cent. Whether the diminished capillary capacity has a direct influence on the vitality of the Phylloxera, or whether through it the roots of the plant are enabled to resist the attack of the insect, is at present undecided.

While there is some plausibility in the theory advanced by M. Saint-André, we believe there are sufficient reasons to account for the diminished virulency of Phylloxera in sandy soil in its mechanical action upon the insect. Our own experiments with both

Phylloxera and many other insects in sand, prove conclusively that it is more difficult for such small, soft-bodied insects to make headway or to exist in sandy soil, not only because of the mechanical action of the particles adhering to all parts of the body, but because of the mobility of these particles and the absence of cracks, interstices and galleries which are formed in loamy or clayey soil, either by the penetration of roots, the effects of contraction during drought, or the action of the insects themselves.—*C. V. Riley in Farmers' Review.*

LOCUSTS IN THE WEST.—Mr. Uriah Bruner wrote us in September from the region of Denver, Colorado, that a few specimens of *Caloptenus spretus* were observed through that part of the country, but that they attracted no particular attention. The *Clifton* (Kansas) *Review* reports that they were seen flying southward over that town the last week of August, while other reports show that, just as we predicted would be the case, the pest was generally scarce in the West and did no damage. It was somewhat different on the Pacific coast. The Pacific migratory species (*Camnula pellucida*) was reported from Fresno as having been very thick on the plains and as doing much damage to vegetation about the middle of July, and we clip the following from the *Pacific Rural Press* of August 27th:

"For the past three years this section has been afflicted by the grasshoppers. As a consequence the farmers have lost all their crops and got heavily in debt. From affluence several have been reduced to poverty. Last year the pestiferous insects laid immense numbers of eggs—in fact the earth was alive with them, and the outlook was very bad for this year, and many did not plant, preferring to let their land lie idle rather than raise a crop of 'hoppers. This season they hatched out in full force, but for some reason they seem to have been panic stricken, and have winged their way in clouds across the Sierras toward California. Only a few are left behind and they can do no particular damage. This year's crop will be a fair one, while next year the harvest ought to be immense. The destination of the pilgrim plague is not yet announced, but the hope is strong that they will be caught in the mountain fastnesses and perish miserably. If our California friends find them pouncing upon their fields, they may expect to see desolation and ruin left in their track."—*Reno Journal.*

Locusts were also very destructive this year in many parts of South America, and we have had several requests from that quarter for the publications of the U. S. Entomological Commission. In Europe, judging from reports, Turkey seems to have been overrun by what is evidently the common *migratoria*, the whole population of Smyrna being employed to combat them. At Angora, report says, "all business was suspended for three days by order of the Governor General, and all the inhabitants were ordered to march out into the fields to destroy the grasshoppers. Every inhabitant was compelled to deliver twenty oka (about fifty-six pounds) of dead locusts to the officials." The swarms are said to emanate principally from Persia.

STRUCTURE OF THE CLAW IN PSOCINA.—Dr. H. A. Hagen has, in *Psyche* for April, 1881, the first part of a paper entitled "Some

Psocina of the United States," in which he calls attention to the curious structure of the claws possessed by many Psocina. The basis of the claw is enlarged beneath in the manner of a blunt projection with what appear to be two strong bristles of unequal length. Under a strong magnifying power it appears, however, that the longer of these bristles is in reality a kind of hose or funnel, open at tip and finely striate. In a few instances Dr. Hagen observed in the interior of the funnel a large number of very fine threads ending in a little knob. The functional character of this structure remains unexplained.

Insect Collection for Sale.—The collection of Coleoptera of the late Mr. C. Trabant of New Orleans, who was a zealous and careful collector and student of insects, is offered for sale by his widow. We are informed that this collection consists of nearly 10,000 specimens, representing about 2000 species, and, from a sample box sent us, we can attest that the specimens are in fair condition and that the collection is well worth the low price ($200) asked for it, and which includes the cabinet. The whole cabinet consists of 40 large drawers, 26 of which are filled with North American beetles (chiefly from Louisiana, Mississippi and Texas), and 10 with Coleoptera from Europe. For further particulars apply to H. D. Schmidt, M. D., 263½ Canal street, New Orleans, La.

ANTHROPOLOGY.[1]

Professor Baird's Report for 1880—Owing to the great strain on the Government Printing Office at Washington, matter prepared for the press is compelled to lie for months before publication. This is true of the Smithsonian Annual Report. The matter was ready for the printer six months ago, but we have just received the preliminary pamphlet, and shall have to wait some weeks yet for the bound volume. The portions especially valuable to anthropologists in Professsor Baird's Report, are Cushing's explorations among the Indians of the Zuñi Pueblo, Capt. Bendire's researches in the Northwest, Boehmer's index to Smithsonian Publications in archæology and ethnology, Vol. XXII of Contributions to Knowledge (containing Jones' "Explorations of the aboriginal remains of Tennessee;" Habel's "Sculptures of Santa Lucia Cosumalwhuapa in Guatemala;" Charles Rau's "Archæological collection of the United States National Museum;" Charles Rau's "Palenque Tablet," and W. H. Dall's "Remains of later prehistoric Man obtained from the caves in the Catharine archipelago"). Further notes will be found upon the antiquities of Antigua and Guadaloupe, and upon the Annual Report of 1879.

Peabody Museum of American Archæology and Ethnology.—The fourteenth annual report of this famous institution, marked

[1] Edited by Professor Otis T. Mason, 1305 Q. street, N. W., Washington, D. C.

also Vol. III, No. 1, contains the reports of the curator, Professor F. W. Putnam, and that of the treasurer, together with a list of donations to the museum. In this notice the last shall be first. The authorities of the museum could do no wiser thing than to practice the most scrupulous care in giving credit to its benefactors. It is astonishing what an amount of hard work many individuals will perform merely to see their name in print in honorable connections. To put it in their language: "I want my children or my friends to see what I have done for science." In this matter of credit the Peabody is not only scrupulous, but is very wise in being so. The amount charged to the curator for the year's work is $11,295.44, which no doubt has been properly audited, though we have not much talent in detecting errors in that direction. The useful part of the report is the account of the year's work by the curator.

Changes in Mya and Lunatia since the deposition of the New England Shell-heaps, by Edward S. Morse, before the A. A. A. S. in Cincinnati.—This communication embraced a comparison between the shells peculiar to the ancient deposits made by the Indians along the coast of New England and similar species living on the coast at the present time. He referred to similar comparisons which he had made in Japan, wherein he had found marked changes to have taken place; changes which showed that the proportions of the shells had greatly altered. He had made a large number of measurements of shells from a few shell heaps of Maine and Massachusetts, and had obtained very interesting results. The common clam (Mya) from the shell heaps of Goose island, Maine, Ipswich, Mass., and Marblehead, Mass., in comparison with recent forms of the same species, collected in the immediate vicinity of these ancient deposits, showed that the ancient specimens were higher in comparison with their length than the recent specimens.

A comparison of the common beach cockle (Lunatia) from the shell-heaps of Marblehead, Mass., showed that the present form had a more depressed spire than the recent form living on the shore to-day, and this variation was in accordance with observations he had made on a similar species in Japan.

Ancient Japanese Bronze Bells, by Edward S. Morse, *Ibid.*—Mr. Morse described the so-called Japanese bronze bells which are dug up in Japan. These bells had been described and figured by Professor Monroe, in the Proceedings of N. Y. Acad. of Sciences. Mr. Kanda, an eminent Japanese archæologist, had questioned their being bells, from their peculiar structure. Mr. Morse had seen a number of different kinds of bells, some of considerable antiquity, but none of them approaching these so-called bronze bells. Mr. Kanda had suggested that they were the ornaments which were formerly hung from the corners of pagoda roofs, but the fact that none of them showed signs of wear at the point of support, rendered this supposition untenable. Mr. John Robinson, of Salem, the author of a work on Ferns, has given the first suggestion as to the possible use of these objects. He has asked why they may not have been covers to incense burners. Curiously enough old incense burners are dug up which have the same oval shape that a section of the bell shows. The bell has openings at the base and also at the sides and top, so that the smoke of burning incense might escape. It is quite evident that these objects are neither bells nor pagoda ornaments, and this suggestion of Mr. Robinson's may possibly lead to some clue regarding their origin.

Worked Shells in New England Shell-heaps, by Edw. S. Morse, *Ibid.*—Mr. Morse called attention to the fact that heretofore no worked shells had been discovered in the New England shell-heaps. A similar absence of worked shells had been noticed in the Japanese shell-heaps. Worked shells were not uncommon in the shell heaps of Florida and California. Mr. Morse then exhibited specimens of the large beach cockle (Lunatia) which showed unmistakable signs of having been worked. The work consisted in cutting out a portion of the outer whorl near the suture. To show that this portion could not be artificially broken, he exhibited naturally broken specimens of the same species, both recent and ancient, in which the fractures were entirely unlike the worked shells.

Congres et Missions Ethnographiques. — From Professor John T. Short, of Columbus, Ohio, we are in receipt of a circular stating the programme and list of delegates for the second session of this body to be held at Geneva, in 1882, on the 10th of April. The labors will be divided into seven sections:

I. Ethnogeny: Origin and migrations of races.

II. Ethnology: Development of nations by environment, geographic position, climate and aliment.

III. Descriptive ethnography: Distribution and classification of peoples, nations, and nationalities over the earth.

IV. Theoretic ethnography: The conditions of the development of nationalities.

V. Ethic. Manners and customs of nations.

VI. Political ethnography: The bases on which the existence of nations rests. Motives which have induced them to group themselves into great States, or to subdivide to secure the advantages of centralization.

VII. Ethnodicy. International law. The comparative study of legislations from an ethnographic point of view.

The delegates for our country are Professor John T. Short, of Columbus, Ohio, and Dr. Francis Parkman, Boston, Mass. Either of which gentlemen will be glad to furnish further information respecting the congress.

Italian Anthropology.—Two original memoirs appear in the Archivio, Vol. xi, Fasc. 1:

Maestrelli, Dr.—The exponent of vital capacity.

Amadeè, Dr. Giuseppe—Numerical anomalies in the human dental system.

GEOLOGY AND PALÆONTOLOGY.

A new type of Perissodactyla.—In a paper on the "homologies and origin of the molar teeth of the Mammalia Educabilia, published in March, 1874,[1] I ventured the generalization that the primitive types of the Ungulata would be discovered to be characterized by the possession of five-toed plantigrade feet, and tubercular teeth. No Perissodactyle or Artiodactyle mammal was known at that time to possess such feet, nor was any Perissodactyle known to possess tubercular teeth. Shortly after advancing the above hypothesis, I discovered the foot structure of *Coryphodon,* which is five-toed and plantigrade, but the teeth are not of the tubercular type. For this and allied genera, I defined a new order, the *Amblypoda,* and I have published the confident anticipation that genera would be discovered which should possess tubercular (bunodont) teeth. This prediction has not yet been realized. I now, however, record a discovery, which goes far towards satisfying the generalization first mentioned, and indicates that the realization of the prophecy respecting the *Amblypoda*, is only a question of time.

In 1873,[2] I described from teeth alone, a genus under the name of *Phenacodus*, and although a good many specimens of the dentition have come into my possession since that date, I have never been able to assign the genus its true position in the mammalian class. The teeth resemble those of suilline Ungulates, but I have never had sufficient evidence to permit its reference to that group. Allied genera recently discovered by me, have been stated to have a hog-like dentition, but that their position could not be determined until the structure of the feet shall have been ascertained.

In his recent explorations in the Wasatch Eocene of Wyoming, Mr. J. L. Wortman was fortunate enough to discover a nearly entire skeleton of a *Phenacodus* very near the typical *P. primævus*, which presents all the characters essential to a full determination of its place in the system. The unexpected result is, that this genus must be referred to the order *Perissodactyla*, and that, with its allies, it must form a special division of that order corresponding in the tubercular characters of its teeth with the bunodont or suilline division of the *Artiodactyla*. In this character, however, there is a closer gradation than in the case of the *Artiodactyla*,

[1] Journal of the Academy of Natural Sciences Philadelphia.

[2] Palæontological Bulletin No. 17, Oct., 1873, p. 3; also, Report G. M. Wheeler, U. S. Engineers Expl. W. 100 Mer., iv, p. 174—1877.

and it would scarcely be necessary to create such a group on that character alone. But the genus differs further from the *Perissodactyla* and approaches the *Proboscidia*, in the fact that the astragalus articulates with the navicular only, and by a universally convex surface, as in the Carnivora.

The astragalus resembles that of the latter order very closely, and differs from that of *Hyracotherium* and the nearest forms among the *Perissodactyla*. *Phenacodus* has moreover five well developed toes on all the feet, and was probably not entirely plantigrade. The cast of the brain case shows that the celebral hemispheres were quite small and nearly smooth, and that the very large cerebellum and olfactory lobes were entirely uncovered by them. The bones of the two carpal rows alternate with each other, and there is a large third trochanter of the femur. The cervical vertebræ are opisthocœlous. The systematic position of the genus may be schematically represented as follows:

Order PERISSODACTYLA; ungulate; digits of unequal lengths; carpal bones alternating; a postglenoid process. Astragalus with proximal trochlea, and without distal double ginglymus.

Suborder *Diplarthra*; astragalus distally plane or concave in one direction, and uniting with both navicular and cuboid bones; a third trochanter of the femur. The known families belong here.

Suborder *Condylarthra;* astragalus convex in all directions distally, only uniting with navicular bone; a third trochanter of femur.

Family *Phenacodontidæ.* Molar teeth tubercular; the premolar teeth different from the molars; five digits on all the feet.

Genera; *Phenacodus* Cope, and very probably *Catathlæus*,[1] *Mioclænus,* and *Protogonia*[2] Cope, and perhaps also *Anisonchus* Cope. These genera include fifteen species, all from the lower Eocene beds. The Condylarthra are then the ancestral type of the known *Perissodactyla*, that is of the horses, tapirs and rhinoceroses, and of the numerous extinct forms.—*E. D. Cope.*

NEW GENUS OF PERISSODACTYLA DIPLARTHRA.—Good specimens of the *Hyracotherium tapirinum* Cope, show that the superior dentition is uninterrupted from the canine inclusive. It thus differs from *Hyracotherium* which has one or two diastemata. The fourth inferior premolar is like the third premolar. The *H. tapirinum* may then be referred to a new genus under the name *Systemodon.*—*E. D. Cope.*

NOTES ON CREODONTA.—A fine series of specimens of *Mesonyx* demonstrates the following points: (1) Pachyæna was founded on a superior molar of *Mesonyx*, and must be suppressed. (2) Apterodon Fischer, is the same as *Mesonyx.* (3) *Mesonyx*

[1] AMERICAN NATURALIST, October, 1880.

[2] Proceedings Amer. Philosoph. Soc., September, 1881.

navajovius Cope[1] must be separated as a distinct genus, since the apices of the crowns of the last two molars have two cusps. This genus may be called *Dissacus*. (4) It results that there are four species of *Mesonyx: M. ossifragus* Cope, *M. lanius* Cope, *M. obtusidens* Cope, and *M. gaudryi* Fisch. *M. ossifragus* was the largest Creodont of the Eocene, equaling the largest grizzly bear in the size of its skull.

The number of possible combinations of tubercular and tubercular-sectorial molar teeth is considerable, and many of them are represented in the genera of the *Creodonta*. A new one must now be added, in a genus which has, in the lower jaw, two tubercular sectorials, and one tubercular posterior to them. The genus thus stands between *Stypolophus* and *Didymictis*, but is nearer the former than the latter, since it has three true molars. It differs further from both in having but three premolars and a wide diastema. The canine is well developed. I call the genus *Lipodectes*, and describe two species, both from the Lowest Eocene, probably Puerco, of New Mexico.

Lipodectes penetrans, sp. nov., represented by a left mandibular ramus with three of the molars preserved. The last has a long heel; the first and second true molars are alike, and resemble those of *Triïsodon*, but the appendicular cusps are better developed. The anterior inner cusp is, however, smaller than the others and is nearly median in position. The heel is elevated on its external border into a strong triangular cusp. The posterior border rises into an acute cusp, which is internal to the middle line. The internal border of the heel is not elevated, and the surface is the oblique inner face of the external cusp. The anterior cusps are only moderately elevated and the cusps are acute. The enamel is smooth, and there is a low cingulum on the external base. The first (second) premolar is two-rooted, and has a large base. The second (third) consists principally of an elevated cusp with a subtriangular section. The heel is very small and acute, and there is no anterior basal tubercle. The internal face is strongly grooved in front. Canines directed upwards, with robust base. Symphysis short. Length of molar series, .043; of premolars, .019; of diastema, .012; length of base of last molar, .010; do of canine, .007; depth of ramus at last molar, .018; of diastema, .015. As large as, but more robust, than the red fox.

Lipodectes pelvidens. This species is about the size of *L. penetrans*, and differs from it in the less carnassial character of the inferior molars. The anterior cusps are relatively smaller in every way, and are more distinctly separated by deeper emarginations. The heel is wider, and has a less elongated external marginal cusp. The inner margin of the heel is elevated, enclosing a basin-like fossa, and rises into a flat cusp posteriorly. There is

[1] Palæontological Bulletin, No. 33, p. 454.

a small median posterior marginal tubercle, which runs into a posterior cingulum, and is wanting from the *L. penetrans*. The tubercular has the three anterior cusps distinct as in *Didymictis* sp., while the heel is longer than in the known species of that genus. Its external border rises into a prominent cusp with triangular base. The fourth premolar has a small heel on the inner posterior side, and an acute anterior basal cusp. The principal cusp is robust and the basal portion is widely grooved posteriorly (apex lost). True molars with an external cingulum. Enamel obsoletely wrinkled. Length of true molar series, .024; of fourth premolar, .0075; length of last molar, .008; width of heel of second true molar, .005; length of crown of do., .007.—*E. D. Cope.*

THE PERMIAN FORMATION OF NEW MEXICO.—This formation is richly fossiliferous in New Mexico, and the vertebrates include several of the types already known from Texas and Illinois. Such are, among reptiles, the genera *Diadectes*, *Dimetrodon* and probably *Clepsydrops*. Of batrachians there are two genera, *Eryops*, and what is probably *Zatrachys*. *Diplodus* represents the fishes. All the individuals, and hence, probably, the species, are of smaller size than those of the Texan Permian, resembling in this respect those found in Illinois. Two species of batrachians of the genera above mentioned, are new, and may be described as follows:

Eryops reticulatus.—The most prominent peculiarity of this species is seen in the neural spines, which are not expanded at the summit as in *E. megacephalus*, but have rather contracted apices. Another character is the sharply reticulate sculpture of the maxillary bones. The species is much smaller than the *E. megacephalus*, or even than the *Trimerorhachus insignis*, and the extent of ossification of the vertebral elements is intermediate between the two species. The inferior surfaces of the intercentra are smooth, and the diapophyses are compressed. The occipital condyles are depressed and not very well distinguished inferiorly. The humeri have expanded extremities with enlarged epicondyles and well developed condyles, and no epitrochlear foramen. Width of occipital condyles, m. .016; elevation of dorsal vertebra, .024; width of intercentrum, .011; length of intercentrum (below), .007; five maxillary teeth in .015.

Zatrachys apicalis.—Represented by vertebræ and dermal bones. The summits of the neural spines are expanded, and the superior faces of the expansions are tubercular and have a median prominence. The expansions are sometimes large, resembling the dermal bones of crocodiles, and in that case the median prominence is a keel. On the smaller expansions the latter is a mere apex. There are narrow flat bones which I suppose to be neural spines, which are ornamented with inosculating ridges. A capitular head of a diapophysis is compressed. Intercentra well ossified, those preserved without lateral notch. Inferior surface with crowded small fossæ, giving a delicate reticulate relief. Length of an intercentrum, .013; width of do., .014; width of the summit of a neural spine, .020; length of do., .014; width of a second do, .025; length of do., 015; width of a third (two unite), .034; length of do., .039. The reference of this species is provisional only. It is much larger than the *Z. serratus*.—*E. D. Cope.*

New Carboniferous fossils in Scotland.—In a recent number of *Nature*, Professor Geikie describes a remarkable discovery of fossils in Scotland. The present hoard has been found among that range of hills or uplands familiar to travelers who enter Scotland from the south, which form a barrier between the valleys of the border on the one hand and the Scottish lowlands on the other. This belt of pastoral high grounds has a special interest for the geologist; he can trace it back to its origin about the close of the Silurian period; and since the old red sandstone, notwithstanding submergence, elevation, and denudation, the ridge has continued to form a barrier between the basins on its northern and southern margin. During every part of the carboniferous period these southern uplands of Scotland formed a barrier between the lagoons of the lowlands and the more open waters to the south which spread over the north and centre of England. For some years past the Geological Survey of Scotland, has been engaged in the detailed investigation of the carboniferous rocks between the Silurian uplands and the English border. In the course of the work, one particular zone of shale on the banks of the River Esk, has been found to possess extraordinary palæontological value. From this stratum, where exposed for a few square yards by the edge of the river, a larger number of new organisms has been exhumed by the Survey than has been obtained from the entire carboniferous system of Scotland for years past. As a whole, the remains are in an excellent state of preservation. Indeed, in some instances they have been so admirably wrapped up in their matrix of fine clay as to retain structures which have never before been recognized in a fossile state. The more important treasures from the shales of Eskdale and Liddesdale are fishes, crustaceans, and arachnids. Dr. R. H. Traquair, the eminent palæontologist, in his report on the fossils, points out the extraordinary interest of the collection, both as opening up an almost entirely new fish fauna, and as revealing remarkable peculiarities in the structure of many of the new forms. Out of 28 species of ganoids, no fewer than 20, at least, are new. Of the 16 genera in which these species are comprised, five are now for the first time added to science, of which one (Tarrasius) is altogether so peculiar that no place can be found for it in any known family. The common forms of the Lothians are conspicuous by their absence in Eskdale and Liddesdale. These facts suggest interesting problems in carboniferous geography and in ancient zoölogical distribution. Associated with the skeletons of the fishes are the remains of some new phyllopod and decapod crustaceans, which have been worked out by Mr. B. N. Peach, the acting palæontologist to the society. One of the most interesting features of this great find, however, is the abundant and often admirably preserved specimens of scorpions, which have enabled Mr. Peach to work out in detail the structure of this interesting creature, doubtless the father of all spiders. In anticipation of the publication of Mr. Peach's descriptions, Professor Geikie gives some notes on the subject. Mr. Peach finds that these palæozoic forms differ in no essential respect from the living scorpion so far as regards external organs. He has recognized in them every structure of the recent form, down even to hairs and hooks on the feet. The sting alone has not been certainly observed, but that it existed may be inferred from the presence of the poison-gland which Mr. Peach has detected in the fossil state. The chief difference between the living scorpion and its ancient progenitors, lies in the fact that in the fossil forms the mesial eyes are much larger in proportion to the lateral ones, and also to the size of the whole animal. The two mesial eyes are placed on an eminence near the anterior margin of the carapace formed by two converging tubes, and so arranged that the creature could look with them upwards, outwards and forwards. There are at least four lateral eyes on each side. The mandibles, palpi and four pairs of walking legs are beautifully distinct on many specimens. The combs are much like those of the modern scorpion, but with a very remarkable sculpturing which at once recalls that so characteristic of the Eurypterids. As regards theories of descent, these fossils afford no more help in tracing the pedigree of the scorpion than is furnished by the living form. There can be little doubt that the scorpion is the most ancient type of arachnid, whence the others have been derived.—*London Times.*

Stegocephali in Saxony.—Fossil remains of several species of *Stegocephali* have been discovered in the neighborhood of Dresden, Germany. Professor Credner, of Leipzic, publishes in the Zeitschrift of the Deutschen Geologischen Gesselschaft for 1881, a first installment of descriptions of the species. This includes the *Branchiosaurus gracilis* Credner, which is represented by several well preserved skeletons. *Branchiosaurus* belongs to the "Microsaurian" subdivision.

Fossil Organisms in Meteorites—Dr. O. Hahn, who will be remembered for the part he took in the "Eozoön" controversy, claims to have established the existence of fossil organisms in sections of meteorites, and his views have been confirmed by Professor Karsten and Dr. D. F. Weinland, the former of whom recognized vegetable forms, while Dr. Hahn was only able to find animal organisms. To enable a better judgment to be formed by the preparations made by Dr. Hahn, 32 photo-lithographic plates are given of 142 transparent sections. Dr. Weinland estimates that there are fifty various species of polyps, crinoids and algæ in Dr. Hahn's preparations.

"These 'celestial fossils' tell us of a planet on which aquatic life was sufficiently developed to produce them and to preserve them after death by a process of infiltration with siliceous material which dissolved the lime of which their structure must have consisted, as far as their inorganic constituents are concerned, and supplanted it by the various kinds of siliceous materials, filling up also the interstices and openings which had formerly contained organic substance. This planet, therefore, must have had a comparatively long period of existence; it must have had an atmosphere, and its surface must in whole or in part have been covered by water. Since bacteria are known to be able to withstand a temperature of 100° C., without losing vitality, the Thomson-Richter hypothesis of the propagation of life through the universe becomes almost a tangible reality."

It is nevertheless extremely probable that Dr. Hahn and friends have been deceived, and a great deal more evidence will be required by biologists before crediting these alleged discoveries. —*Eds.*

Geological News.—Professor J. W. Dawson has had a fine series of photographs executed which represent the *Batrachia* of the Coal measures of Nova Scotia, some of them new species. One of the latter is referred to a new genus, *Fritschia.*——In the Bulletin of the U. S. Geological Survey of the Territories, Professor A. S. Packard, Jr., discusses the extinct craw-fishes.——In the same, Professor Cope reviews the osteology of the *Rodentia* of the Miocene period of North America.——In this Bulletin also, the same author describes some of the *Canidæ* of the Loup Fork formation. He shows that the genus *Ælurodon* belongs to that family, and describes the *Æ. hyænoides* as new. *Canis brachypus* is a new species from the Ticholeptus beds.——At the late meeting of the British Association for the Advancement of Science, Dr. H. G. Seeley described the characteristics of the Plesiosauroid genus *Simosaurus.* He finds that while the anterior feet are adapted for swimming, as in *Plesiosaurus*, the posterior ones are adapted for progression on land, having curved claws. He thinks that the genus represents a transition between terrestrial and aquatic types, and that the origin of *Plesiosaurus* from a land reptile is thus clearly indicated. This reminds us of the *Neustosaurus gigondarum* of Raspail, described in 1842, which was said to have a similar structure, and which, Professor Bronn remarked in Lethæa Geognostica, "ist nicht zu glauben ohne zu sehen!"

GEOGRAPHY AND TRAVELS.[1]

Proceedings of the Geographical Section of the British Association.—The fifty-first meeting of the British Association for the Advancement of Science, held at York from the 31st of August to the 7th of September, was chiefly occupied in reviewing the progress of science in the various departments during the fifty years of the society's existence. The address of the president of the geographical section, Sir J. D. Hooker was devoted to the growth of our knowledge of the Geographical Distribution of Organic Beings. He briefly alluded to the unprecedently great advance made in the last fifty years in our knowledge of the unknown regions of the earth.

"The veil has been withdrawn from the sources of the Nile and the lake systems of Central Africa have been approximately localized and outlined. Australia, never previously traversed, has been crossed and recrossed in various directions. New Guinea has had its coasts surveyed, and its previously utterly unknown interior has been here and there visited. The topography of Western China and Central Asia, which had been sealed books since the days of Marco Polo, has been explored in many quarters. The elevations of the highest mountains of both hemispheres have been accurately determined, and themselves ascended to heights never before attained; and the upper regions of the air have been ballooned to the extreme limits beyond which the life-sustaining organs of the human frame can no longer perform their functions. In hydrography the depths of the great oceans have been sounded, their shores mapped, and their physical and natural history explored from the equator to beyond both polar circles. In the Arctic regions the highest hitherto attained latitudes have been reached; Greenland has been proved to be an island; and an archipelago has been discovered nearer to the Pole than any other land. In the Antarctic regions a new continent has been added to our maps, crowned with one of the loftiest known volcanoes, and the Antarctic Ocean has been twice traversed to the 79th parallel. Nor have some of the negative results of modern exploration been less important for the Mountains of the Moon and many lesser chains have been expunged from our maps, and there are no longer believers in the inland sea of Australia or in the open ocean of the Arctic pole."

A paper was read by Sir Richard Temple, On the Progress of our geographical knowledge of Asia during the last fifty years. "The area of Asia contains seventeen millions of English square miles. Out of this about two-thirds consists of mountains and table-lands whereof a large part is desert; and one-third of lowlands, wherein a small part is desert; the rest of the lowlands being arable, of which again a considerable portion is cultivated. Thus out of the whole area not more than one-sixth is under

[1] Edited by Ellis H. Yarnall, Philadelphia.

cultivation; among the populated tracts, however, some are the most densely peopled in the world."

"In the midst of the continent is a great central plateau, more than two millions of English square miles in area, rising to great altitudes, which dominates the river systems and the drainage of the greater part of Asia and which is bounded by the Himalayas towards the Indian Ocean, by the Yun-ling and the Inshan Mountains towards the Pacific Ocean, by the Altai and Yablonoi ranges towards the Arctic Ocean, and by the Pamir Mountains towards the inland seas, the Aral and the Caspian. The Pamir Mountains constitute a group connecting the great ranges of Himalaya and Altai. Branching off from this central plateau is another extensive plateau with an average altitude of 5000 feet above the sea, which includes Afghanistan, Beluchistan, Persia, Armenia, and Asia Minor, and from a small part of which the drainage is towards the Atlantic Ocean through the Black Sea and the Mediterranean. It is through Asia Minor and the Caucasus that the Asiatic Mountains are connected with the ranges of southern Europe. It is remarkable that from within this central plateau, walled round as it is by mountain ranges, there rise most of the greatest Asiatic rivers which burst through the mountains in order to make a passage towards the sea. Such, for instance, are the Indus with its affluent the Satlej, the Brahmaputra, the Ganges, the Irawady, the Salwen, the Cambodia or Mekong, flowing into the Indian Ocean; the Yang-tsze Kiang, the Hoang-Ho, the Amur, flowing into the Pacific Ocean; the Lena, the Yenisei, and the Ob flowing into the Arctic Ocean; the Jaxartes and the Oxus flowing into the inland sea of Aral. Many other rivers which though lesser are still very great, take their sources from the outer slopes of the mountains which surround the central plateau.

Next after the oceanic drainage, the inland Asiatic drainage, which finds no vent towards the ocean, may claim attention as being the largest in the world, and as occupying nearly four millions of English square miles or nearly one-fourth of the Asiatic continent. This extraordinary drainage area may be divided into the following categories:—1st, the Caspian; 2d, the Aral; 3d, the Balkash [Siberian]; 4th, Lake Lob [Yarkand]; 5th, Koko-Nor; 6th, the lesser lake of Tibet; 7th, the lesser lakes of Altai; 8th, the Helmand draining nearly all Afghanistan into the Seistan swamps; 9th, the Kavir or saline deserts in Eastern Persia; 10th, the lake of Urumiya in Northwestern Persia; 11th, Lake Van in Kurdistan; 12th, the Dead Sea.

The central plateau is made up of several plateaux having different altitudes. The highest is that of Tibet, on the average 15,000 feet above the sea, the loftiest in the world; next, that of Pamir, 13,000 feet; then that of Koko-Nor, 10,000 feet. Next we see a sudden dip or depression, namely, that of Yarkand or

Western Gobi, only 3000 feet above the sea; then there follow two steps upwards, namely, that of Eastern Gobi, 4000 feet; and lastly that of Altai, 5000 feet.

The central plateau has been the home of most of the nomad and pastoral tribes which have successfully overrun the rest of Asia. It now belongs [with the exception of one tract] to the Chinese empire.

Dividing the continent into eight political divisions Sir Richard Temple gives a condensed, but satisfactory review of the work accomplished in them since 1830, and mention is made of all the principal explorers and writers. In conclusion he says, "The greater part of Asia has not yet been touched by scientific operations on a complete scale. In the whole of Asia only India, Ceylon, Cyprus, Western Palestine, Caucasia, the Caspian basin, part of Western Siberia, and part of Japan, also many points in the Asiatic coastline, have been subjected to trigonometrical observation. The altitudes of mountains have been determined only in the Himalayas, the Caucasus and the Urals by trigonometry. But in many ranges the heights have been approximately ascertained by the barometer. Professional surveys in detail have been completed only in India, Ceylon, Western Palestine, Caucasia, parts of Western and Eastern Siberia, the Tian-Shan region, the greater part of Western Turkistan, Cambodia, parts of Cochin China, parts of Afghanistan, also on certain lines of Persia, Mesopotamia, and Asia Minor.

Even in the professionally surveyed territories many defects and imperfections are acknowledged to remain. Non-professional surveys have been carried out in Japan, in China proper, in parts of Arabia, on the frontiers of Tibet, China, and Burma, and on certain lines in Afghanistan and Beluchistan."

"Of geological surveys, the largest example is that in India which, though far advanced, is far from complete. Very much remains to be done in this respect for the Himalayas. Geological surveys have been made in the Caucasus, the Urals, the Tian-Shan and Altai ranges, Kamchatka, many parts of China and Japan, Cambodia, Ceylon, some parts of Arabia and Persia, much of Asia Minor and Palestine. But there remain unexplored, parts of the Himalayas, of Afghanistan and Beluchistan, of Arabia, nearly the whole Kuen-Lun region north of Tibet in the very heart of Asia.

Further the following are among the principal geographical problems still awaiting solution:—The connection of the Tibetan San-po with the Indian Brahmaputra; the existence of mountains connecting the Kuen-Lun range eastwards with the Chinese ranges; the sources and upper courses of the Irawady, Salwen, Mekong and Hoang-Ho, the disposition of the mountains between the Ladakh passes and the Hindu-Kush or Indian Causasus north of Caubul, near to the culminating region of the entire continent."

Papers were read as follows: The equipment of exploring expeditions now and fifty years ago, by Francis Galton, F. R. S.; On the survey of Western Palestine, by the Palestine Exploration Fund, by Trelawny Saunders; A review of Oceanic or Maritime discovery, exploration and research, during the half-century, 1831–81, by Captain Sir Frederick Evans, R. N., F. R. S., Hydrographer of the Admiralty.

HUDSON'S BAY.—Dr. Robert Bell, Assistant Director of the Geological Survey of Canada, recently read before the Royal Geographical Society a paper on the Commercial Importance of Hudson's Bay. He gave an interesting account of that great North American sea. "In the popular mind Hudson's Bay is apt to be associated with the polar regions, yet no part of it comes within the Arctic circle, and the southern extremity is south of the latitude of London. Few people have any adequate conception of the extent of this great American sea. Including its southern prolongation, James' Bay, it measures about 1000 miles in length and it is more than 600 miles in width at its northern part. Its total area is approximately 500,000 square miles, or upwards of half that of the Mediterranean Sea of the old world. It is enclosed by the land on all sides except the northeast, where it communicates by several channels with the outer ocean. The principal or best known of these is Hudson's Strait, which is about 500 miles in length, and has an average width of about 100 miles.

"Hudson's Bay, which might have been more appropriately called Hudson's Sea, is the central basin of the drainage of North America. The limits of this basin extend to the centre of the Labrador peninsula, or some 500 miles inland on the east side and to the Rocky Mountains, or a distance of 1300 miles on the west. The Winnipeg Basin constitutes a sort of outlier of the region more immediately under notice, since the waters drain into it from north, south, east and west, and discharge themselves by one great trunk—the Nelson river—into Hudson's Bay. The southernmost portion of this basin, namely, the source of the Red River, extends down nearly to latitude 45°. The headwaters of the southern rivers of James' Bay are not far to the north of Lake Huron; while one of the branches of the Albany rises within 25 miles of the north shore of Lake Superior. Including the Winnipeg system, the basin of Hudson's Bay has a width of about 2100 miles from east to west, and a length of about 1500 miles from north to south, and its dimensions approach the enormous area of 3,000,000 square miles." * * * "Both the bay and strait are remarkably free from rock and shoals which might interfere with their free navigation."

Churchill Harbor on the west side can be entered by vessels of the largest size, and is thought likely to be the future shipping port for the agricultural and mineral products of the vast Northwest Territory. The shortest route between this territory and

England is through Hudson's Bay. Even the city of Winnipeg, near the southeastern extremity, is at least 800 miles nearer to Liverpool by the Hudson's Bay route than by the St. Lawrence.

As regards the difficulties caused by ice, Dr. Bell believes that the strait and bay may be navigated and the land approached by steamer during an average of four and a-half months each year, or from the middle of June to the end of October. The bay itself and probably the straits are open all the year round—it is only the harbors that are closed.

MICROSCOPY.[1]

AMERICAN SOCIETY OF MICROSCOPISTS.—The executive committee of this society has decided to accept the invitation of the Elmira Microscopical Society, and to convene the next annual meeting of the society at that city, Elmira, N. Y., on Tuesday, Aug. 17, 1882, at 10 A. M. It is expected that the meetings will occupy four days, the final adjournment occurring Friday evening or Saturday morning, leaving ample time for those who wish to attend the Montreal meeting of the A. A. A. S. to reach Montreal by Tuesday, Aug. 24th. Many important papers have already been promised, and there is every reason to believe that the attendance will be large and the proceedings important. The local society at Elmira has taken up the work of preparing for the reception and entertainment of the society, with great enthusiasm, and will doubtless carry it out with marked success.

The committee appointed to consider and report upon the possibility of securing greater uniformity in the sizes of oculars produced by different makers, and some definite and uniform nomenclature in regard to their amplifying powers, has issued a circular to all manufacturers in this country asking information and co-operation. In the interest of the future convenience and satisfaction of all parties concerned, it is hoped that makers and dealers will cordially unite with the society in attempting by all reasonable means to secure so desirable an object. Those makers who may have failed to receive the circular can obtain copies from any member of the committee which consists of the following Ex-Presidents and present President of the Society: R. H. Ward, Troy, N. Y., H. L. Smith, Geneva, N. Y., J. D. Hyatt, Morrisana, N. Y., Geo. E. Blackham, Dunkirk, N. Y.

The Griffith prize, consisting of a Bausch and Lomb ½ inch objective of 98° air angle (0.76 numerical aperture) is to be awarded at this meeting to the author of the best paper presented on the adulteration of some important article of food or medicine. Papers are to be accompanied by permanently mounted slides illustrating the points under discussion. Names of competitors are to remain unknown until after the announcement of the

[1] This department is edited by Dr. R. H. WARD, Troy, N. Y.

award. Persons intending to become members of the Society at the coming meeting can compete on the same terms as present members. Circulars giving particulars as to the required method of competition can be obtained from the Secretary, Professor D. S. Kellicott, Buffalo, N. Y.

VERIFICATION OF OBJECTIVES.—The editor of the *Northern Microscopist* (Manchester, England), announces the opening of a verification department, in which it is proposed to publish, for a fee of eighteen pence to cover expenses, information in regard to any objective sent for examination. The following measurements will be given :—focal length and angular aperture as estimated by maker; linear amplifying power, working focal distance, and absolute size of field, at ten inches from front lens of objective to plane surface of eye-lens of ocular (which is a Ross A, with diaphragm aperture of 0.75 inch, and approximate magnifying power of 5 diameters); numerical aperture by Professor Abbe's apertometer, and calculated equivalent air angle. Though not likely to work without some friction, this department will, if permanently successful, be a great convenience to those owners or intended purchasers of lenses, who have not the experience or apparatus requisite to test them for themselves. It would be still more satisfactory, and would probably conduce to the increased success of such as might adopt the plan, if makers and dealers would have their lenses similarly examined and certified to by competent and impartial authority, before offering them for sale.

MOUNTING ON SQUARE SLIPS.—Mr. J. Fenner proposes, in the *English Mechanic*, to mount microscope objects on glass one inch square instead of the standard 3x1 slips. These are to be placed in shallow circular paper boxes, just large enough to contain them, which may be obtained cheaply in large quantities at the wholesale drug stores. The slide is to be covered with a cardboard diaphragm snugly fitted into the box, perforated by a central opening through which to view the object, and covered with a gummed label. The bottom of the box has a central opening (previously punched through it) for the transmission of light; and the cover is labeled and numbered to correspond with the box and with the owner's register-book. As none of the slide is visible except the central portion immediately around the object, great skill or care is not required in giving an elegant finish to the cell or to the outline of the mounting medium. Such mounts, which can be easily and satisfactorily prepared by inexpert persons, have no top or bottom edge, but can be placed on the stage in any position, and rotated by the hand. They are evidently not suitable for delicate work or for use with high powers.

MICROSCOPIC TEST FOR POISON.—To test fluids for such minute quantities of certain alkaloids as would not answer to chemical procedure, Professor Rossbach places, uncovered, on a slide, a drop of water containing Infusoria, to which, being carefully examined, a little of the suspected fluid is applied. If organic poison be present the Infusoria become a formless sediment. 1–15,000,000 of a grain of atropine may be thus detected.—*Science Gossip*.

Slides of Marine Algæ.—Rev. A. B. Hervey of Taunton, Mass., will mail to any address, for two dollars, a set of six slides showing the characteristic fruit of the six great groups into which Professor Agardh divides the Red Algæ.

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SCIENTIFIC NEWS.

— A number of final reports of the Norwegian North Atlantic Expedition have recently appeared. It has been found, says the New York *Nation*, that free carbonic acid does not exist in ordinary sea-water, which indeed has an alkaline reaction, but that it is present in the form of carbonates, and in a less degree of bi-carbonates. In regard to saltness, a remarkable fact was determined, which has a most important bearing on various theories of oceanic circulation—namely, that the excess of salt noticeable and expected in the warm Atlantic current water was not confined to it, but almost equally characterized the deep strata, which were reduced to the freezing point. This water is, therefore, not a Polar indraught, as has been supposed, Arctic or Antarctic, but is tropical surface water, which has been cooled; while the Polar water continues equally distinguished from it by its deficient saltness, and appears to allow the cooled salt water of the surface to sink through it without mixing, and to form on the bottom certain portions of what has been called the "cold area."

Six or seven new species of fishes, a ray, a sucking pout *(Liparis)*, several species of Lycodes, were discovered, together with a translucent "ghost," with ventral fins reduced to long biped filaments attached to the throat, and with no scales, which was called *Rhodichthys regina*. It was brought up from a depth of a mile and a half in the open sea between Jan Mayen and Finmark.

— The Fourth Annual Book of the Michigan Sportsmen's Association is an interesting document. This is one of the most useful of such societies, and is doing a good work in cultivating the proper tone in regard to the preservation of game, a matter in which every naturalist is interested. How important the subject is, may be seen upon reading the article by Prof. Roney on the destruction of deer in 1880, and the necessity of prohibitory export laws. It appears that in 1877, in two months, 15,000 deer were killed in Michigan, of which, at least, 8,500 were exported from the State. In 1878, a grand total of 1,600,000 pounds of venison, or about 21,000 deer were slaughtered, of which 13,500 were killed by still hunters, 3,000 of these being killed for the hides alone, and the balance shipped out of the State to Eastern, Southern and Western markets. In 1880, the destruction of deer was greater than ever before in the history of the State, 10,000 deer being shipped from fifteen stations alone, and the total number of deer killed being 70,000, or about 10,000,000 pounds of venison. This shocking destruction of deer is paralleled by the wanton destruction of game farther west. Organized societies, which demand and create proper legislation to prevent this evil, are doing a great work for civilization.

— Prof. S. A. Forbes has spent the last two months exploring, with sounding line, dredges and beam trawl, the small lakes of Northeastern Illinois, Geneva lake in Wisconsin and some parts of Lake Michigan, viz.: the southwest part, off Chicago, from the shore to seven miles out, and the regions of Grand Traverse bay in Michigan. In the latter he dredged and hauled the trawl in 105 fathoms. He also used the towing net everywhere, with very interesting results. The most important collections made are those of mollusks, deep-water crustaceans, entomostracans and Cottoid fishes. The species collected in Lake Michigan by Stimpson and Miller, and afterwards lost in the Chicago fire, were obtained in abundance, and some were found not reported by previous collectors. The greatest novelties occur among the entomostraca.

The beam trawl was found admirably adapted to the collection of Cottoids, but few other fishes were taken by it. In the smaller lakes it took nothing not obtainable by the use of the dredge.

Full notes were kept of the vertical range of plant and animal life, and of the relative abundance of species at various depths. The results will be reported in detail in the bulletins of the Illinois State Laboratory of Natural History.

— The bread distributed on a recent occasion to a cavalry detachment in a garrison at Oran, in Algeria, was moldy, covered with dark and orange cryptogamic vegetation, though made only 48 hours previously. The men refused to eat it, and mostly threw it away; but some offered it to their horses, who scarcely touched it, with exception of two, which ate each about half a kilogramme. The consequence was a true poisoning, not followed by death, but seriously injuring one of the horses. (Such poisoning of animals has been known to occur before.) M. Megnin was led to study the substances developed on the bread, and he found there were two kinds of mold, one *Ascophora nigricans* forming a flaky cover of sooty-color; the other, *Oidium aurantiacum*, forming spots of salmon-color, and with great power of multiplication. M. Megnin believes the sporules of these molds existed in the flour before the bread was made. He cultivated the molds specially and experimented on dogs with them. The sickness and vomiting were much more violent with the *Ascophora nigricans*, but the other had considerable action.

— Dr. Chavanne has published a hypsometrical map of Africa, and has calculated, from 8000 hypsometrical measurements, the average height of the whole continent, which he finds to be no less than 661.8 metres (with a probable error of ± metres). This very high figure obviously, says *Nature*, is the result of the very great extension of high plateaux, which we do not find to such an extent even in Asia.

— The glacier of Zerafshan, which is sixteen miles long, has been explored throughout its whole length; it has thirteen secondary glaciers. The Ala-taon mountains, in Asia, are also covered with mighty glaciers; these mountains are from 10,000 to 16,000 feet high.

— Texas is to have a State university. The governor has called the regents to meet at Austin to make a permanent organization preparatory to the establishment of the university.

— Dr. Gustaf Linnarson, the well-known palæontologist of the Swedish Geological Survey, died in September last at the age of 40 years.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

National Academy of Sciences.—Titles of papers read at Philadelphia meeting, commencing November 15, 1881:

On a gigantic Salpa found in the Gulf Stream. By Professor A. Agassiz.
The Echini of the Challenger Expedition. By Professor A. Agassiz.
The Classification of the Dinosauria. By Professor O. C. Marsh.
Succession in time of the Allotheria. By Professor O. C. Marsh.
Distribution of the Corals of Tortugas. Professor A. Agassiz
The Porpitidæ and Velellidæ of the Gulf Stream. By Professor A. Agassiz.
Complex Organic Acids. By Professor W. Gibbs.
The theory of Dynamo-Electric Machines. By Professor W. Gibbs.
The Phenacodontidæ, a new group of Perissodactyla. By Professor E. D. Cope.

Second day, Nov. 16:

A comparison between the shells of the Kjockkmödings of the coast of New England and the present shells of the same species. By Professor E. S. Morse.
The expedition to Mount Whitney, with observations on solar energy. By Professor S. B. Langley.
A peculiar vein containing gold and silver found in the Sierra Negretta or Black range. By Professor B. Silliman.
On the Life and Labors of Professor S. S. Haldemann. By Professor J. P. Lesley.
Logic of Numbers. By Professor Charles Pierce.
Chinoline Synthesis for Medical Uses. By Professor Henry Morton.
Hydrometer Scales. By Professor C. F. Chandler.
The Velocity of Light. By Professor Simon Newcomb.

Third day, Nov. 18:

Sorghum and some conclusions as to its value as a source of sugar. Read by invitation by Peter Collier.
Maschart's Electrometer and its use as a meteorological instrument. By Professor Geo. F. Barker.
The Fossil and recent Faunæ of the Oregon and Idaho deserts in relation to the antiquity of man. By Professor E. D. Cope.

Proceedings of the American Philosophical Society, March 18, 1881.—A memoir On the Preglacial drainage of Lake Erie and other great lakes, by Dr. J. W. Spencer, was read and illustrated by the secretary. A paper on a geological section at St. Marys, in Elk county, Pa., was read by Mr. Ashburner.

April 1.—Prof. W. M. Fontaine offered for publication in the Transactions of the Society, a memoir on the Rhætic flora and the formation to which they belong, in Virginia and North Carolina. Mr. Mansfield, of Connelton, Beaver county, Pa., communicated by letter a drawing, life size, of a fine fossil, *Eurypterus*, found by him in the shale immediately beneath the Darlington cannel beds, lower productive coal measures. Mr. E. B. Harden presented two models in plaster, one geologically colored, the other uncolored, of a large portion of Blair county, Pa., on a scale of 8000′ 1″, vertical scale exaggerated two and a-half times. Captain E. Y. McCauley, U.S.N., communicated for publication in the Proceedings, An alphabet and syllabary of the Egyptian language for the use of students.

April 15.—A drawing and a description of his improved "Centigrad Photometer," was received from D. Coglievina of Vienna. Professor P. E. Chase explained certain relations of the spectrum line F with other lines and data, suggesting the probable identity of hydrogen and the luminiferous æther. Professor E. D. Cope read a paper on the classification of the Perissodactyla. Dr. König made remarks on Dr. P. F. Reinsch's plates of the microscopic lithology of the Anthracite and other coals. Mr. Lesley communicated an appendix to Dr. Spencer's paper on the Lake Erie former water-basin, suggesting the probable course of the upper Ohio from Pittsburgh to Butler, thence via New Castle, up the present Mahoning valley, and down the grand valley of the Ohio to Lake Erie.

May 6.—Mr. Frazer exhibited coins, also specimens of granite, cement, lead, bronze and steel, used by the Egyptians in erecting the obelisk, now in New York, and sections of the granite under the microscope. Mr. Ashburner exhibited a suite of maps of one of the British coal fields. Dr. Chance communicated a paper, entitled "An analysis of the fire damp explosions in the Anthracite coal mines from 1876 to 1880."

June 17.—Communications were made as follows, viz.: 1. Note on the Geology of West Virginia, by J. C. White. 2. A Series of Standard Units, by Pliny E. Chase. 3. On Alaska, by Prof. George A. König.

July 15.—The following communications were read: 1. On the Argilliferous Gravels of North Carolina, by H. M. Chance, M. D. 2. The Brain of the Cat, *Felis domesticus*, with four plates, by Burt G. Wilder, Prof. Anatomy in Cornell University. 3. The Vagus Nerve of the Cat, with four plates, by T. B. Stowell.

September 17.—Professor Cope communicated a paper, entitled "On Some Mammalia of the Lowest Eocene of New Mexico."

October 7.—Professor J. J. Stevenson communicated through the Secretary as follows: "Notes on the Coal-field near Cañon City, Colorado. Notes on the Quinnimont coal group in Mercer Co., W. Va., and Tazewell Co., Va. By John J. Stevenson, Professor of Geology in the University of the City of New York. Professor Cope exhibited a very perfect lower jaw of a marsupialoid type with carnivorous characters from New Mexico. On splitting the jaw he found beneath a genuine and perfect marsupial fourth premolar, a concealed perfect successional tooth of carnivorous type. In front of it was another and smaller concealed successional tooth of the same type. He named the animal *Triïsodon quivirensis*. Professor Cope exhibited, also, a tooth of an animal from the Lower Eocene of New Mexico, the importance of which lay in the fact that proved the continued existence of the Jurassic (Purbeck) *Plagiaulax* type through the Cretaceous to Tertiary times. He names the Lower Eocene form *Ptilodus mediævus*.

October 21.—Professor Haupt exhibited specimens of natural terra cotta produced by spontaneous combustion in the lignite of the Badlands, and used for ballasting the Northern Pacific R. R. Mr. Lesley exhibited a recent completed map of the Bald Eagle mountain and Birmingham hills in Blair and Huntingdon counties, Pa., drawn by E. B. & O. B. Harden, for the purpose of explaining the difficult structure of the Sinking Valley faulted anticlinal, &c. Mr. Lesley read "Notes on a possible Adite element in the early history of Egypt."

Middlesex Institute, Mass., Sept. 7.—A free public exhibition of native autumn flowers was given. Among the novelties shown was *Solidago bicolor, var. concolor* from Malden, collected by Henry L. Moody, who was also fortunate enough to find, *just over the county line* and in Essex county, *Pedicularis lanceolata* Michx., a most interesting discovery for this region. Mr. Frohock exhibited *Echium vulgare* from Summerville. The collection of Asters and golden rods was particularly fine, considering the unfortunately hot weather prevailing at the time, and the whole exhibition creditable to the Institute and to the ladies who contributed so much towards its success.

Sept. 14.—Mr. Davenport read a paper on "Some Internal Visual Phenomena," which was followed by a most interesting discussion in which Messrs. Moody, Gleason, Dame, Frohock, Collins and others participated.

Boston Society of Natural History, October 19.—Prof. A. Hyatt discussed the formation through disease of movable joints in lobster claws; Mr. N. F. Merrill read a paper on the Lithological Collection of the Survey of the Fortieth Parallel, and Dr. M. E. Wadsworth gave some items relating to the Geology of Eastern Massachusetts.

November 2.—Mr. W. O. Crosby discussed the Classification of the textures and structures of rocks; Dr. M. E. Wadsworth spoke of the Trachyte of Marblehead Neck; and Mr. William Trelease described the Nectar-glands in the peduncle of the Cowpea.

APPALACHIAN MOUNTAIN CLUB, October 12.—Mr. W. H. Pickering spoke of a trip made this summer over Passaconaway and Whiteface, and Prof. C. E. Fay spoke of the discovery of a natural camp in King's Ravine. Other informal reports of summer excursions were made, and on the 15th, the Club made an autumn excursion, visiting the Uncanoonucs, near Manchester, N. H.

Nov. 9.—The Councillors presented their reports of work done during the summer. Mr. F. W. Parker spoke of a recent trip through the region north of Moosehead lake, and Mrs. R. A. Bradford read a paper entitled, "A sketch of the ascents of Bald and Berlin mountains."

NEW YORK ACADEMY OF SCIENCES, October 17.—The following papers were read: Geological facts recently observed in Idaho, Utah, Nevada and Colorado, by J. S. Newberry. Outlines of the geology of the Northeastern West India islands, by Professor P. T. Cleve (of Sweden).

Oct. 24.—Notes on the physiology of vision, with modifications in the ordinary theory of the stereoscope, were read by Mr. W. Le Conte Stevens.

Oct. 31.—The following paper was read: The Geology of the Copper region of Northern Texas and the Indian Territory, by John H. Furman.

CALIFORNIA ACADEMY OF SCIENCES, Nov. 4.—Hon. B. B. Redding, president of the board of trustees, announced the very generous and welcome donation of $20,000 to the Academy by Charles Crocker. Charles Wolcott Brooks, secretary of the board, then read the following letter of presentation, and the acknowledgment forwarded to Mr. Crocker by the trustees:

SAN FRANCISCO, NOVEMBER 1, 1881.

To the Trustees of the California Academy of Sciences, San Francisco, Cal.—Gentlemen: Desiring to make an acknowledgment of my appreciation of the benefits conferred upon society through the labors of students and investigators in those branches of science that are popularly supposed not to be practically profitable, I herewith send you $20,000 in Southern Pacific Railroad bonds.

The income from said fund of $20,000 I desire you shall annually expend in assisting in their investigations in California, Oregon, Nevada and Arizona, such worthy and studious investigators, in any branch of science, as have, by their devotion to scientific investigations and experiments, largely and necessarily excluded themselves from acquiring support through the ordinary avocations of current industrial life. Very respectfully,

CHARLES CROCKER.

TORONTO NATURAL HISTORY SOCIETY, Nov. 7.—Henry Montgomery, the president, gave a lengthy address upon "The Relations of the Blastoidea," copiously illustrated by specimens of existing and extinct sea-urchins of various genera, star-fishes, brittle-stars, crinoids, trepangs and Blastoidea of the genera *Pentremites* and *Nucleocrinus.* Of the last-named genus the lecturer exhibited the specimen recently described by him in his paper on "A Blastoid found in the Devonian rocks of Ontario." Mr. William Brodie then showed specimens of fiber from the upper sheaths of the "broom" grass, *Adropogon scoparius*, well adapted for the manufacture of cordage and paper. In his address Mr. Brodie claimed that this grass can be utilized to reclaim dry, sandy, waste land. The samples shown were remarkably tenacious.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

AMERICAN JOURNAL OF SCIENCE, November.—Jurassic birds and their allies, by O. C. Marsh. Local subsidence produced by an ice-sheet, by J. W. McGee. Note on the Laramie group of Southern New Mexico, by J. J. Stevenson. The nature of Cyathophycus, by C. D. Walcott.

THE GEOLOGICAL MAGAZINE, October.—On some points in the morphology of the Rhabdophora, by J. Hopkinson. The glaciation of the Shetlands, by D. M. Home. Differences between the London and Berlin Archæopteryx, by H. G. Seeley.

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THE SIXTEENTH VOLUME OF THE AMERICAN NATURALIST.—Although no promises of enlargement were made to our subscribers at the beginning of the year, we beg to call attention to the fact that Vol. XV contains 1042 pages, or 116 pages more than the preceding volume. The number and variety of illustrations is also greater than in the last volume.

We can assure our readers that from the papers now in hand and those promised, Vol. XVI will certainly not be inferior in variety and interest to any of its predecessors. There is considerable probability that a department of mineralogy will be shortly added.

We would respectfully invite the contributions of original notes and articles, and items of scientific news, and would ask our friends to call the attention of those in any way interested in natural history to our magazine, as an aid and stimulus in their studies and field work. We want to so enlarge our subscription list, that we can offer more illustrations to our patrons.

We would respectfully ask our exchanges to specially notice the December NATURALIST, and to send marked copies containing such notices to the editors.

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ERRATUM.—On p. 943, the line,

"Those matted woods, where birds begin to sing,"

should read,

"Those matted woods, where birds *forget* to sing."