comprehension of the cranial nerves is the doctrine of nerve components as developed (chiefly by American students) during the past decade, a doctrine which apparently very few neurologists in Europe have yet really comprehended. The fifty pages of this work devoted to the peripheral nervous system will serve as an admirable and not too technical introduction to this important subject, and will doubtless hasten the day when it will filter down into the text-books. C. Judson Herrick.

SOCIETIES AND ACADEMIES.

RESEARCH CLUB OF THE UNIVERSITY OF MICHIGAN.

Since last reported this Club has held two meetings, one on December 18, 1901, the other on January 8, 1902.

At the former meeting, Dr. A. R. Cushny read a paper on 'Renal Secretion and Diuresis,' in which he first discussed the two chief theories on the subject and then attempted to apply them to the explanation of the diuresis induced by the intravenous injection of saline solutions. When a mixture of sulphate and chloride of sodium in equal parts is injected, the chloride of the urine first exceeds the sulphate in amount, while later the reverse is the case. This is most simply explained by the reabsorption of chloride in the renal tubules, which take up this salt much more readily than the sulphate. When the absorption is accelerated by partial closure of the ureter, which increases the pressure in the tubules, the chloride of the urine diminishes much more than the sulphate. The behavior of the chloride and sulphate of the urine thus confirms Ludwig's theory that the renal tubules are absorptive rather than secretory organs. In the discussion which followed, it was intimated by the reader of the paper that there were grounds to believe that the secretory cells of the renal capsule are unable to discriminate between sulphate and chloride and that the relative amounts of these in the glomerular fluid is determined by their relative proportion in the plasma of the blood.

At the conclusion of Dr. Cushny's paper, Professor Henry C. Adams spoke on 'Trusts.' Giving at first the older classification of business and commercial organizations as limited by profitable administration, the speaker devoted his time to the enquiry as to whether conditions have so changed as to make possible the profitable combination into one organization of two or more formerly economically distinct classes of business.

At the meeting of January 8, Dr. Guthe spoke on the action of the coherer with special reference to the investigations which he has published in the *Annalen der Physik*, 4, p. 762, 1901, and in the *Physical Review*, 12, p. 245, 1901.

After a short description of the single contact coherer used by him and an explanation of the so-called decohesion, he calculated how near the metallic surfaces must be brought together in order to produce coherer action. The work of Earhart on sparking distances leads to the conclusion that the insulating layer can only have a thickness of a fraction of the wave-length of sodium light, while the distance corresponding to the critical voltages of different metals, as found by him, must be of molecular dimensions. Thus the thickness of the air film, if the original high resistance is really due to such a film, can be only a very small fraction of its normal value. But it seems unnecessary to assume the presence of a layer of air between the surfaces in all cases in which coherence takes place. The decrease in resistance or actual metallic contact between the coherer particles, Dr. Guthe believed to be due mainly to the welding together of the metals at the point of contact by the heat produced when even a minute quantity of electricity passes through an extremely small area of high resistance.

Dr. Guthe was followed by Dr. S. J. Holmes, who spoke on 'The Habits of Amphipods,' detailing many interesting actions in their life history. Portions of the results obtained by Dr. Holmes have been published in the *Biological Bulletin* and in the *American Journal of Physiology*. The later observations have appeared in abstract in Science in the report of the Chicago meeting of the Morphological Society.

Frederick C. Newcombe,
Secretary.

ZOOLOGICAL CLUB, UNIVERSITY OF CHICAGO.
MEETING OF NOV. 20, 1901.

'Experiments in Grafting *Hydra*': MARY HEFFERAN.

These experiments were carried on during the year 1900 at the University of Chicago, and were based upon the similar work of Rand (1899) and Miss Peebles (1900). A comparison of the behavior of lateral grafts in the two species *Hydra fusca* and *Hydra viridis* showed a marked difference in the process of regulation. In the former, the graft moved up the stock until the head ends of stock and graft were of the same length, forming a Y-shaped figure. Then the two trunks gradually fused into one. A graft inserted very low down on the stock, *i. e.*, in the aboral 1/5, might constrict off from the foot. In *Hydra viridis* the process was quite the contrary. The graft moved down the stock instead of up, and finally separated from it at the foot instead of fusing as in *Hydra fusca*. The difference in size of the two species and the action of capillarity is suggested as an explanation of these different processes. In tangent grafts fusion took place the more readily as the area of union was increased in grafting. When poles were reversed separation took place if the area of union was so large that the polyps were unable to twist around in order that fusion could follow with poles in the same direction. It was impossible to build up *Hydra* of abnormal length by grafting several polyps together end to end. Normal form was regained usually by constriction and separation at the point of grafting, or when the compound was not much more than the ordinary length, by gradual reduction through absorption. In a few cases buds formed on such compounds soon after grafting. These buds arose entirely out of the budding region of the individual components, but within what would be the budding zone of the whole. The general results may be summed up in the words of Wetzel, '95: 'Ueberall zeigt sich ein deutliches Streben, die normal Gestalt wieder herzustellen.'

MEETING OF DEC. 4, 1901.

'Some Observations upon the Eye of *Bdellostoma Stouti*': B. M. ALLEN.

The eyes of this Pacific coast myxinoid show a very primitive structure, which is in reality the result of a complex process of degeneration. The eyeball is found imbedded in a mass of fat about three times its size. In one case, the eye was found to lie some distance beneath the outer surface of the mass of fat. Normally, however, the corneal surface lies on a level with the surface of the fat and is often flattened to form a rather extensive free surface. No eye muscles nor traces of such were discovered. No oculomotor nerves were found. No traces of them are discoverable in embryonic life (Kupffer). There is no trace of a crystalline lens. According to G. C. Price and Kupffer, a rudiment of a lens occurs at a very early stage of embryonic life, but very soon disappears. The choroid and sclerotic coats are represented by a very thin layer of unpigmented, non-vascular connective tissue without any appreciable distinction between corneal and sclerotic portions. The retina remains in the early condition of an optic cup, the outer layer (pigment layer) not being fused with the remaining layers. All specimens showed the layer in question to be widely separated from the bulk of the retina. This pigment layer is composed of a single layer of cubical cells devoid of pigment as far as I could ascertain. A layer corresponding to that of the rods and cones in higher vertebrates is clearly present. The nuclei of these structures (outer nuclear layer) are strikingly well developed and regularly arranged. Certain characteristic cells of the inner nuclear layer could be readily made out. It is impossible at present to give an accurate account of the minute histological details of this or of any other part of the retina, owing to the lack of living material. The ganglionic layer is represented by cells scattered irregularly throughout the inner reticular layer. Fibers from these last named cells can be traced in a more or less direct course to the optic nerve. The outer rim of the optic cup is in many cases differentiated in such a manner as to suggest a rudimentary iris. A structure unmistakably like an iris was found in one specimen examined. The cellular structure of this rudimentary iris is almost identical with

that of the pigment layer. No indications of muscle fibers or pigment are to be seen. Certain deeply staining coagula within the optic cup give evidence of a vitreous body. Some large, clearly marked cells, probably those of the vitreous body, are found attached to the surface of the retina. Evidences of a choroid fissure are to be seen in the fact that the ventral portion of the retina is thinner than the dorsal in almost all specimens. In one case the choroid fissure was found to persist. The most striking feature, however, is the extreme variation. The optic nerve enters the eye at various angles. Variation occurs in all parts of the eye, and is especially notable in the measurements of the thickness of the retina and the dimensions of the eye as a whole.

C. M. Child,
Secretary.

BIOLOGICAL SOCIETY OF WASHINGTON.

The 350th regular meeting was held on Saturday evening, February 22.

C. H. Townsend spoke on 'The Present Status of the Carp in American Waters,' saying that in spite of much adverse comment this fish was rapidly assuming an important place in this country and that no less than $400,000 worth was sold annually, largely in New York. It was the source of the principal fishery in the Illinois River where the bass had increased in spite of statements that carp destroyed the spawn and young of bass. The speaker believed that when the proper methods of raising and cooking carp were better appreciated it would find much favor and be an important article of food, especially among those who could not afford the prices for the most desirable species. It would be impossible to propagate the finer species of fish on a sufficient scale to keep pace with our growing population and as the carp could be readily raised it would supply the deficiency caused by the lack of other fishes.

C. P. Hartley presented a paper on 'The Pollenation of Immature Flowers,' saying that, in order to save labor, plant breeders sometimes apply pollen to flowers at the time they emasculate them. Because fair success has often resulted from this method it is now quite universally taken for granted that pollen placed on immature pistils will remain there until the pistils are receptive and then fertilize the flowers. Experiments with tobacco prove that there are flowers that are killed and caused to fall from the plants by being pollenated before their pistils are mature; and microscopic study of flowers so treated shows that the pollen germinates on the stigmas sending pollen tubes down the immature pistils into the ovaries. This growth of pollen tubes in the ovaries among ovules not sufficiently mature to admit of fertilization causes the flowers to fall. Tobacco flowers fall in about thirty-six hours after being prematurely pollenated. If pollenated when almost mature, *i. e.*, eighteen or twenty-four hours before the flowers would have opened, many will set fruit; but if pollenated two, three or even four days before maturity, the flowers invariably fall, separating smoothly from the plant at the base of the peduncles.

Datura flowers are also killed by premature pollenation, though unlike tobacco flowers they do not fall but wither away and fail to develop seeds. Doubtless other kinds of flowers will be found to be injured by premature pollenation. The growth of the pistils of cotton blossoms is checked by premature pollenation and flowers pollenated one day before maturity do not set so many nor produce as good fruits as those pollenated at maturity. Tomato blossoms fail to set fruit when pollenated six days before maturity, the failure being due to loss of vitality in the pollen. If the flowers on becoming mature be again pollenated they set fruits. Orange blossoms pollenated nine days before maturity are not injured but continue their growth and mature good fruits. This is true of seedy as well as of navel oranges and the fact that flowers of the navel oranges so treated result in fruits containing good seeds, proves that the pollen so early placed on the stigmas successfully fertilizes the flowers.

The experiments show that certain kinds of flowers are killed by being pollenated too young; other kinds fail to set fruit because the pollen placed on the young stigma loses its vitality before the pistil becomes receptive,

while still other kinds will set fruits although pollenated while quite immature.

Lyster H. Dewey discussed 'The Identity of Prickly Lettuce,' stating that a plant bearing this common name, and generally considered to be *Lactuca scariola,* was introduced into the United States in the early sixties and spread with such rapidity as to become the most widely distributed exotic weed. During the summer of 1901 specimens of true *L. scariola* with runcinate leaves were received from Hamilton Co., Ohio, and this led to a reexamination of the species. It was at first thought that a common form of the American plant having leaves merely spinulose-margined, but entire or slightly wavy in outline, was *L. virosa* L. This European species however has rather large, oblong-obovate, thin leaves, not twisted to a vertical plane as are the rather thick, firm leaves of our prickly lettuce and further study proved our form to be *L. scariola integrata* Gren. et Gord. A few specimens examined exhibit a gradation between this variety and the typical form.

F. A. Lucas described 'The Armor of *Stegosaurus,*' saying that this consisted of large plates standing on edge on the back and several large spines on the tail. The first Stegosaur, *Omosaurus,* was found in England, and Professor Owen considered that the tail spine belonged on the wrist. The broad dorsal plates found with the first American specimen, belonging to the genus *Stegosaurus,* were thought to have been imbedded in the skin like the much smaller plates of the turtle *Sphargis.* It was soon recognized however that they belonged on the back and the animal was restored with a line of plates down the center of the back. Subsequent study showed clearly that there were two rows of plates, one on either side of the median line, and probably but two pairs of spines on the tail. The most recent comparisons seemed to indicate that the large upright plates were not disposed in pairs, but had an alternating arrangement, although this was unlike the armature or adornment of any other known animal.

F. A. LUCAS.

NEW YORK ACADEMY OF SCIENCES.

SECTION OF GEOLOGY.

THE regular meeting of the Section was held on January 20, with a comparatively large number of members present, and the following program was presented:

Professor R. P. Whitfield read two papers. The first was upon the Ammonite *Heteroceras simplicostatum,* in which he emended and elaborated the description of that species which he had given in the Newton and Jenny Report on the Black Hills, published in 1880, the new observations being based upon material gathered by Dr. E. O. Hovey on an expedition of the American Museum last summer. This material shows conclusively that the three genera *Hamites, Ancyloceras* and *Heteroceras* have no independent existence, because single individuals show the distinguishing characters of all three genera combined. This fact had been suspected by the author when at work upon the Newton material twenty-five years ago, and it has been hinted at in the writings of Hyatt and others, but these were the first specimens described which settled the question.

Professor Whitfield's second paper described a new teredo-like shell from the Laramie group of eastern Wyoming, collected by Mr. Barnum Brown, of the American Museum. This teredo, to which the author has given the name *Xylophomya laramiensis,* is more than an inch in diameter, thus ranking with the largest species of the family known.

These two papers may be found in full in the current volume of the *Bulletin of the American Museum of Natural History.*

The third paper of the evening was by Professor James Douglas and gave a description, illustrated by a topographic map and numerous lantern slides, of the famous Rio Tinto group of the copper mines of the Huelva district in Spain. These mines have been worked from time immemorial, the earliest knowledge of them dating from the Phœnicians, who occupied the country in the eleventh century, B.C. The Romans also obtained a large amount of copper from these deposits, and it is an interesting fact that the slags which they left are purer—that is, freer from copper, than

those which are made there to-day. The ore is a copper-bearing pyrite, carrying some silica. The copper-bearing portions run irregularly through the iron pyrites, and the Rio Tinto Company has removed millions of tons of forty-two per cent. iron ore in getting at its copper ore. The iron ore is not profitable at the present time, although it may become so in the distant future. There are some remains of the workings of the ancients here. At Tharsis, in particular, the old shafts are very peculiarly constructed, one at least being spiral to enable the miners to carry the ore on their backs. Shelves were excavated at intervals in the walls of the shaft to enable the men to rest their loads on their weary journey to the surface.

The mines are worked now as open air diggings in circular terraces. They produce about two million tons of ore per year, and it is estimated that there are one hundred and sixty million tons in sight. Some silver-bearing galena is associated with the copper ore. The old-fashioned method of roasting the ore in heaps was kept up until 1893, but the ore is now leached by means of water. This is a long process, requiring four years for its thorough completion, but the copper is leached out so that less than one-fourth of one per cent. is left in the tailings. The great bulk of the world's supply of sulphuric acid is obtained from the Rio Tinto pyrite, which is shipped all over the world for the purpose of manufacturing the acid. Five hundred thousand tons per year are utilized in this way.

The paper was discussed by Dr. Julien and Mr. Howe, and the Section passed a hearty vote of thanks to Professor Douglas for his kindness in giving the paper.

A REGULAR meeting of the Society was held on February 17, with the Chairman, Dr. A. A. Julien, presiding.

The first paper to be read was by Dr. O. P. Hay, on the 'Snout-fishes of Kansas.' In this paper the author presented a brief history of our knowledge of the genus *Protosphyræna,* and a statement showing what portions of the skeleton were still unknown. Those parts which are best known are the skull, especially the elongated snout, and the jaws, the shoulder and the caudal and pectoral fins. These parts have seldom been found associated, and there have been established three series of species—one on the teeth, one on the snout and the third on the fins. It is certain that, as new collections are made and studied, some of these subspecies will be reduced to synonomy. The author pointed out various errors on the part of writers in the interpretation of different elements of the skeleton, and illustrated his points by means of specimens.

Dr. A. A. Julien gave an impromptu discussion of the relation of honestones to the cutting edge of tools, in the course of which he said that the quality of a hone depended on the size and shape of its component particles, and upon the cement joining the whole together, except in the case of the novaculites from Arkansas, in which the honing quality is due to the sharp edges of minute cavities left by the solution of calcite; and in the case of the Turkey-stone, in which the honing quality is due to veinlets of quartz intersecting a rock which has been formed by silica replacing a granular limestone. A microscopic study shows that the edge of a tool is not regularly serrated, part of it being smooth and part undulatory. Viewed on edge, the sharpest tools are practically straight, while the others are more or less regularly wavy. Viewed in the cross section, a fine edge is seen to be a perfect wedge, while the duller tools show a minute shoulder.

EDMUND O. HOVEY,
Secretary.

SECTION OF BIOLOGY.

AT a regular meeting of the Section, held on February 10, Professor W. B. Scott, of Princeton University, presented an illustrated lecture entitled, 'The Origin and Development of South American Mammals.'

The speaker began by expressing his great obligation to Dr. F. Ameghino, as also to Dr. Moreno, director, and to the curators of the La Plata Museum, for their kindness in giving him the freest use of their collections and enabling him to examine all the types of the Santa Cruz mammals.

The fauna of every continent is made up of

two elements, the indigenous forms which were developed in that continent, and the immigrants from other regions. In South America this distinction is easy to draw, because of the remarkable series of Tertiary deposits which are wonderfully rich in well-preserved fossils. The Santa Cruz beds, which are almost certainly referable to the lower Miocene, contain an assemblage of mammals altogether different from those of the northern hemisphere. The fauna consists of Primates and Insectivora, very scantily represented, very numerous Rodents (though all referable to the Hystricomorphs), Marsupials, Edentates and the peculiar South American hoofed animals. The Edentates of this period represent the Gravigrada, Glyptodonts and Armadillos, but no members of the true Sloths or Anteaters have yet been found, a lack of which is probably due to climatic conditions. The Gravigrada, which are very abundant, have forerunners of all the great Pleistocene groups, but are, of course, much less specialized and are relatively small in size. The Glyptodonts, though numerous and well preserved, are not so easily to be brought into relation with the later genera of the same group.

The paper concluded with a brief examination of the remarkable Ungulates, all of which are peculiar to South America, and especial attention was called to Ameghino's discovery, yet unpublished, that in *Nesodon* there are three sets of functional incisors and canines. Incredible as such an observation may be, it seems to be well established.

HENRY E. CRAMPTON,
Secretary.

THE BOSTON SOCIETY OF NATURAL HISTORY.

AT a meeting of the Society held January 1, 1902, Dr. George H. Parker gave an account of some experiments which he had conducted on the marine Copepod, *Labidocera æstiva,* with a view to accounting for the fact that it is extremely abundant on the surface of the water along shore at night, but during the hours of daylight is found only down in the deeper waters. After giving a short account of the external structure and method of locomotion, the speaker described a series of experiments with these copepods in aquaria, from which it appeared that the females are negatively geotactic, their tendency being to swim against rather than with the force of gravity. They were also found to be attracted by a light of small intensity, but repelled by a brilliant illumination. The reactions to light seem to be stronger than those to gravity. The diurnal migration on the part of the females is thus to be explained as being due to their endeavor to seek a region of such depth below the surface of the water as shall have the requisite intensity of light. The males of this species seemed to show no very definite response to light or gravity, though their reactions indicated that they were to a slight degree negatively phototactic, and positively geotactic. By experiments with females enclosed in small glass tubes, which were covered with filter paper and plugged at the ends with cotton, it seemed evident that the females give out some sort of scent which becomes disseminated throughout the immediately surrounding water, and is strongly attractive to the males. The males, then, perform the same diurnal migration as the females, because they are attracted by the scent of the latter, and so follow in their wake. Mr. C. J. Maynard then gave an account of the habits and structure of the Anhinga and the Courlan, two Florida birds. Among the specimens shown was a preparation of the peculiar convolution of the trachea in the adult male of the latter species, a striking secondary sexual character.

At the meeting of January 15, 1902, Mr. William L. W. Field gave an account of a 'Glacial Lake Problem in Southern Vermont.' The region studied covers a portion of the basins of the Black and the Williams rivers, tributaries of the Connecticut. At a certain locality the courses of these two rivers approximate rather closely, and at this region there are two passes connecting the respective river basins, the one very narrow, with steep sides, locally known as Proctorsville Gulf, the other, farther down the valley, much broader and apparently widened to a considerable extent by ice action. From a study of the sedi-

ments and the topographic features, it seemed probable that during the recession of the glacial ice-sheet a lake had been formed, which, as the ice melted out, had discharged first through the upper pass, and later through the lower one. A number of lantern slides were shown in illustration of the topographic features of the area under discussion.

GLOVER M. ALLEN,
Secretary.

DISCUSSION AND CORRESPONDENCE.

THE ENDOWMENT OF RESEARCH.

TO THE EDITOR OF SCIENCE: I have been much impressed by the communication of Mr. H. H. Clayton in your recent issue, in relation to the subject of grants for scientific research, for the reason that his views coincide so closely with mine, based on both theoretical considerations and practical experience.

On two occasions I have been the recipient of such grants, and I confess that on each occasion I labored under a feeling of constant uneasiness for fear that I might not be able to accomplish what others might consider adequate returns for the amount of the grant. This feeling may have no reason for existence and perhaps it does injustice to those who have such funds in charge, but that it exists and that it has a distinct influence upon many applicants can not be questioned. It may perhaps be objected that such persons should not, or at least that they need not, seek to avail themselves of such opportunities, but this, it seems to me, would merely result in debarring many conscientous workers, while at the same time encouraging others not so sensitive.

In regard to the effect of prohibiting the payment of personal expenses out of research funds I may not be considered a competent witness, for the reason that in the two instances mentioned I was not restricted as to the manner in which the grants should be expended and it was never necessary for me to try to draw a hard and fast line between what might be considered purely personal expenses and those which were incurred solely in connection with the actual research work. Had such restrictions been imposed, however, I believe that I should have hesitated to accept the first grant and know that I should have declined the second, on account of my inability to satisfy myself that I could draw a line so that items on either side could not be questioned or criticized.

In common, as I have reason to believe, with nearly every active scientific worker, I have always had sufficient work under way, or definitely planned, to occupy all my time for months and sometimes for years ahead, and tardiness in completing investigations has more often been due to the element of personal expenses than to any other cause. Such a condition is particularly in evidence where investigations involve the necessity of traveling. Good results can hardly be expected if the investigator is constantly harassed by having to consider whether each item of expense may be conscientiously charged to his research fund or not. The success or failure of an investigation in the field may often depend entirely upon the length of time which can be given to it, or, what is the same thing, to the sum available merely for living expenses.

In regard to laboratory work I can not speak from experience, but I do not see why any different principle should prevail in that connection than in any other. The proper basis for a grant, it seems to me, should be absolute confidence in the recipient, giving him to understand that the amount of the grant was his, to apply in any way which he might think would best accomplish, or assist in accomplishing, the object of his investigations.

ARTHUR HOLLICK.

SCIENTIFIC NOMENCLATURE.

A PRIME characteristic of the scientific mind is the ability to enter into details and to make distinctions, as well as to see the relation between the elements of knowledge. In order that some conception of these distinctions may be communicated to another mind, names must be given to a perpetually increasing list of objects and qualities, with divisions and subdivisions. In natural science, to try to stretch an existing vocabulary and make it cover new conceptions by using old names with new