the upper atmosphere, and the author has ascertained that the analogous optical effects were observed in the eastern United States about twenty days later than in central Europe, which, assuming a movement from the west of the dust-bearing currents, indicates an approximate velocity of thirty miles an hour, or considerably less than that of the highest ice-clouds. After the Krakatoa eruption in 1883 the rate of propagation of the volcanic dust from east to west, at a height above the equator calculated from the duration of the sunset colors, was determined with considerable accuracy by a committee appointed by the Royal Society, and it is hoped that sufficient observations will now be collected to enable the velocity of the highest currents above the temperate regions to be deduced equally well.

DAYTON C. MILLER,
Secretary.

ZOOLOGY AT THE ST. LOUIS MEETING.

SECTION F of the American Association for the Advancement of Science and the Central Branch of the American Society of Zoologists met in joint sessions at the St. Louis Meeting for the reading of papers, but held separate business meetings. On Monday afternoon, December 28, the address of Vice-President Hargitt before Section F was read by Professor C. C. Nutting, in the absence of the author, the subject being 'Some Unsolved Problems of Organic Adaptation.' Section F was organized with the following officers:

Vice-President—E. L. Mark, Harvard University.

Secretary—C. Judson Herrick, Denison University.

Councilor—A. M. Bleile.

Sectional Committee—E. L. Mark, Vice-President 1904; C. W. Hargitt, Vice-President, 1903; C. Judson Herrick, Secretary, 1904–1908. For one year, H. F. Osborn; for two years, S. H. Gage; for three years, C. H. Eigenmann; for four years, H. B. Ward; for five years, Frank Smith.

Member of General Committee—Jacob Reighard.

Press Secretary—C. Judson Herrick.

Joint sessions for the reading of papers were held on Tuesday and Wednesday, at which the following communications were presented. Titles preceded by an asterisk were presented by Section F; others by the Society of Zoologists.

**The Albatross Rookeries on Laysan:* C. C. NUTTING, University of Iowa.

An exhibit of lantern slides after original photographs taken by the author during the Hawaiian cruise of the *Albatross* in May, 1902.

A Restricted Habitat of Scutigerella immaculata (Newport), together with some remarks on the Animal and its Habits: STEPHEN R. WILLIAMS, Oxford, O.

In the bed of a small branch of Four Mile Creek, a tributary of the Great Miami River, a comparatively large number of specimens of this little centipede have been found. As far as ascertained the range of this particular group of this species is limited to a part of the bed of this small branch perhaps 600 feet in length. A discussion of the surroundings in general, the precise habitat which the animals seek, some of their observed habits in captivity, and one instance of breeding in confinement, were included. Larvæ have been kept through one molt and certain bodies which may possibly be eggs have been seen.

On the Analogy between the Departure from Optimum Vital Conditions and Departure from Geographic Life Centers: CHARLES C. ADAMS, University of Michigan.

In a previous paper (*Biological Bulletin*, III., 115–131) the writer briefly discussed some of the criteria which may be used to determine geographic life centers, and certain functional and structural changes resulting from departure from such centers. At the present time attention is called to

other principles involved in radiate dispersal and the significance of these principles in the interpretation of certain ecological laws, habitats and faunal areas. There are certain well-known physiological laws which must be borne in mind. The natural starting point is the vital optimum. Departure from this optimum has a certain definite result. The new vital conditions are a cause of stimulation, and with further departure (beyond a certain limit) lead to increased stimulation or to unfavorable conditions. This results in retarded growth, development and reproduction of the organism as a whole. Thus the end results of extreme departure from the optimum in either direction are similar. In many respects a center of geographic origin is analogous to a vital optimum and any departure from such a center may result in effects similar to those brought about by a departure from the vital optimum, retarded growth, development and reproduction. The results of extreme departures from such a center are also remarkably similar. In view of these relations, many apparently isolated distributional and ecological facts may be correlated.

**A Feature in the Evolution of the Trotting Horse:* FRANCIS E. NIPHER, St. Louis, Missouri.

Twenty years ago the author published an equation representing the relation between the speed of the trotting horse and the time measured from any assumed date. The date for the origin of any speed was determined by the rate of increase in the number of horses capable of making that speed. It was, therefore, determined without any reference to the date when some individual horse broke the world's record. The author drew the curve represented by the equation published in 1882, and plotted the observed cases from 1845 to date when the record was actually broken upon the same diagram. The general agreement of these experiments with the curve is very striking. The points representing the observed speed of record-breaking horses are found to group themselves into steps corresponding to generations of the horse. Flora Temple found the horse slow on the computed speed represented by the curve. She put the horse ahead. The same is true of Dexter, of Goldsmith Maid, of Maud S. and of Nancy Hanks. The diagram shows that this evolution of speed is not a continuous operation, but that it goes on in steps or jumps. In 1892 the new sulky with ball bearings made a similar jump in the time of trotting a mile. It is very likely that this advance will also be taken up in time, and will correspond to less radical improvements made in the old sulky before 1892. A photograph of the diagram was exhibited. On the same diagram the performance of the running horse is shown from three widely separated records.

Further Observations on the Breeding Habits and on the Function of the Pearl Organs in Several Species of Eventognathi: JACOB REIGHARD, University of Michigan.

At the Washington meeting of the society the writer described the breeding habits of the horned dace, stone-roller and black-headed dace. In the breeding season the males of these forms possess hard, spine-like thickenings of the epidermis known as pearl organs. The function of these transient structures had been hitherto a matter of conjecture, but it was shown that they are used by the males of some species in their battles with one another and in building their nests, while in the males of all species the chief function of the organs was shown to be that of enabling the male to hold the female during the spawning act. In the present paper

the writer reviewed his work on the horned dace and showed instantaneous photographs of the spawning fish. He described further the breeding habits of the common shiner, in which the function of the pearl organs is essentially the same as in the horned dace. He described also the breeding habits of the back sucker. In this form the spine-like pearl organs occur in rows on the lower half of the sides of the tail and on the enlarged anal of the male. In spawning the female is held by two males, one on either side of her. The rough anals and caudals of the two males press against the sides of the body and tail of the female, and hold her in place. They also press against one another beneath and behind the female, and thus hold the two males side by side. Spawning is accomplished by a rapid vibration of the tails of the three fishes, and during the act the eggs and milt are emitted and mingled with the sand and gravel which have been stirred up.

Phototaxis in Ranatra: S. J. Holmes, University of Michigan.

Ranatra shows under ordinary circumstances a marked positive phototaxis. Individuals when in the water keep swimming vigorously for a long time in the endeavor to go towards the lightest portion of their environment. When taken out of the water *Ranatras* at first feign death, lying practically motionless for several minutes. If a strong light is moved about near them they come out of their feint much more quickly than when left entirely alone, and soon begin to follow the light with much vigor. The first responses, however, are slight and consist of a small lateral movement of the head when the light is moved from side to side. Shortly after this the animal will respond by vertical head movements as the light is moved back and forth over the long axis of the body. Moving the light around in a circle, the head responds by circular movements of a most regular and precise kind. For every position of the light there is a corresponding attitude of the head. Next following the head reflexes come the reflex movements of the respiratory tube, which becomes raised and lowered coincident with the head as the light is moved to and fro above the body. After a greater or less interval the animal rises on its legs, and if the light is now moved from side to side, the body will perform swaying movements, leaning over strongly towards the side on which the light is held. The legs on the side towards the light are strongly flexed, while those on the opposite side are held in a state of extension. If the light is passed to and fro in a longitudinal direction corresponding swaying movements are likewise performed. When the light is in front, the animal bows down; when it is moved behind, the anterior end of the body is elevated, often at an angle of forty-five degrees. Moving the light around the animal in a circle, the body follows with corresponding motions. These responses are so regular and definite that one might almost tell what particular attitude of the body, legs and head will be assumed for a given position of the light. Light in *Ranatra* apparently produces a powerful effect upon the tension of the muscles and may be made to control the behavior of the creature in a most precise and arbitrary manner.

**Studies on Protoplasmic Structure:* A. W. Greeley, Washington University, St. Louis.

The influence of chemical, electrical, thermal and osmotic stimuli upon the protoplasmic structure. The effect of these variations in structure upon the elementary vital phenomena, with special refer-

ence to the chemotropic and galvanotropic reactions.

Amitosis in the Embryo of Fasciolaria: HENRY LESLIE OSBORN, Hamline University, St. Paul, Minnesota. (Read by title.)

Very early embryos of *Fasciolaria* exhibit amitosis, a fact of interest because direct nuclear division is seldom seen in embryos. The embryos are in the gastrula stage, the various organs of the head, foot and visceral regions not yet having begun to put in an appearance. The *Fasciolaria* embryo is very peculiar in being greatly dilated by the large number of primitive ova which it has swallowed to serve as food. Each of these ova is a large mass of small yolk grains enclosed by a distinct cell wall and permeated by cytoplasm containing nuclei. The endoderm is composed of cubical cells in which one sees nuclei in all stages of direct division. In addition to the ordinary form of amitosis, one also sees here certain very large nuclei, constricting at various points as if in an act of giving rise to nuclei by gemmation. Mitotic figures are also seen in the endoderm. A part of the endoderm of the embryo soon becomes much enlarged and vacuolated, and is evidently the seat of active secretory processes connected with the digestion of the yolk. The amitosis can thus be considered as coming in line with Ziegler's view that it is an accompaniment of secretory activity in the cells, but it is not in accord with that part of his theory which attaches amitosis to cell senescence. The embryo possesses peculiar external organs, the larval kidneys, which gradually assume a large size, though purely provisional structures. They lie directly under the velum and are made up of ectodermal cells swollen to huge dimensions by the accumulation within them of a homogeneous, faintly-staining material. It is generally supposed that these are excretory organs. In the outer ends of the cells one finds strong indications of amitosis. Here, of course, amitosis is occurring in cells which, though an important part of the body of the larva for the time being, are in reality secretory cells and not destined subsequently to give rise to new cells. Nuclear divisions are found in the food-ova, which are plainly degenerative, and the ova soon after break up and lose their identity altogether. These nuclear divisions appear to be amitotic. They are clearly connected with cell senescence.

**On the Morphology of Artificial Parthenogenesis in the Sea-urchin, Arbacia:* S. J. HUNTER, University of Kansas.

The unfertilized eggs of *Arbacia* subjected to the influence of sea water concentrated by evaporation to three fourths its normal volume for about two hours may, when transferred to sterilized sea water, develop into free-swimming plutei. The subsequent behavior of the eggs is dependent upon the stage of maturation attained when placed in the concentrated solution. Both cytoplasm and nucleus are concerned in development. Eggs isolated and placed under continuous observation until blastulation at first become amœboid, nuclear division following, sometimes repeated several times before cleavage of cytoplasm occurs. Cleavage is not total nor progressive, partial or complete fusion of blastomeres intervening. Cleavage prior to blastulation is at no time comparable with normal processes. Different embryos show wide variations in character of external changes. At blastulation ectoderm cells are formed over large cells, generally three in number. The blastula does not become ciliated and free-swimming before nine hours. Mesenchyma cells are thrown off from the vegetable pole into the blastocœle. The amœboid activity spoken of begins at

about the time of first cleavage in normal fertilization, the rate of development falls gradually behind the normal, being in specific cases as 2:3 at the moment of active swimming, and 1:2 in time of development of pluteus. The artificial gastrulæ are less symmetrical and less active than the normal forms. The pluteus three days old, by measurements, equals in size the normal pluteus a day and half old, differing in lack of symmetry and poorly developed skeletal spicules. Mouth, œsophagus and stomach are present, but no anal opening has been noted. Development in fused fragments is similar to that of the whole egg, except that no fusions are known to have become plutei. No membrane appears, but a perivitelline membrane surrounds eggs placed in a solution composed of 50 cc. of $2\frac{1}{2}$ *n* $MgCl_2$ solution and 50 cc. of sea water for from one to two hours. The same effect, though in not so great a percentage of eggs, is obtained by use of $2\frac{1}{2}$ *n* NaCl solution in same proportions.

The primary nucleus equals in size and eccentric position in egg (as revealed in sections) the nucleus of oötids measured in sections of the ovary. The nucleus advances to the center, enlarges. A small aster with central dark body (parthenocentrosome) appears in contact with exterior of nuclear membrane. This divides to form the amphiaster. The various phases of mitosis ensue. The chromatin nucleolus contributes to formation of chromosomes. These are between twelve and fourteen in number. In a few cultures the nucleus was amœboid in movement and amitotic in division. From such cultures no larval forms developed. Both cleavage asters and cytasters contain central bodies similar to centrosome of fertilization. These bodies appear to be formed *de novo,* and in the case of the cleavage asters there is evidence which suggests that their origin may be in the second polar body. Cytasters appear to divide and are sometimes centers of cleavage. They are more abundant in oötids placed in the concentrated solution. Nuclear division is not necessarily followed by cytoplasmic cleavage. Cleavage of the cytoplasm is preceded by nuclear division.

**Biological Interpretation of Skew Variation:* Frank E. Lutz, University of Chicago. (Read by title.)

A departure from the 'normal' curve of biological measures may be brought about either (1) by removal of a number of individuals from one side of the mean, (2) by increase of individuals or (3) a combination of the two. In skewness caused by removal, we have, in the sign of the skewness, a prophecy of the direction of variation. In skewness caused by the starting of a new race about a mean within the range of the old race, skewness would be prophetic at the beginning of evolution and historic at the end. The distance between the two means is a factor determining the uni- or bi-modality of the combination curve. Skewness as the result of both addition and removal seems too complicated for present analysis. And in no case have we, at the present time, enough data to interpret definitely, in any particular case, the significance of skew variation.

The Correlation of Brain Weight with other Characters: Raymond Pearl, University of Michigan.

**The Relation between the Law of Ancestral Heredity and Mendelianism:* Frank E. Lutz. (Read by title.)

The 'purity of the germ' idea applies quite as well to the law of ancestral heredity as to Mendelianism and is in harmony with it. The confusion seems to have arisen because of the difficulty in distinguishing between the different grades of intensity of the characters used in certain

lines of work. If we suppose four males, having conditions of the character in question, which we may represent as *ab, ef, ij* and *nm,* borne by their germ cells, to mate with four females bearing this character in the conditions *cd, gh, kl* and *op;* and if we mate their successive generations, we shall always get the old Galtonian formula. If, however, we suppose the conditions of the character, which we have represented by various letters as borne by the males, to be indistinguishable *inter se*, so that we may represent them all by x; and, likewise, those of the female by y; and if we then go through the same hypothetical mating as above, we get the Mendelian formula. It would be dangerous to insist upon a strict adherence to 'purity of the germ.' External and internal factors undoubtedly influence it. It is also improbable that a case could be found in which, by careful work, gradations of the character in question could not be found. We would, therefore, conclude that the Mendelian school arose either by an unfortunate selection of data (taking something in which the variations of the character were hard to perceive and measure), or by a careless handling of the data used.

Evolution without Mutation: C. B. DAVENPORT, University of Chicago.

While recognizing that mutation is an important factor in evolution, the author finds, from a statistical study of geographical and paleontological series, that the transitions between species of the scallop (*Pecten*) may be graduated, and of the order of individual variations. Thus the Pectens from Cape Hatteras are intermediate in their qualities between those from Cold Spring Harbor, Long Island, and Tampa, Florida.

Also the fossil *Pecten ebonus* of the Pliocene Nansemond River (Virginia) beds taken from the lowest to the highest beds leads in a uniform series towards the recent *P. irradians* of North Carolina.

**Studies in Compensatory Regulation:* CHARLES ZELENY, University of Chicago.

The ontogenetic development of the opercula in the serpulid *Hydroides* corresponds very closely with the probable phylogenetic development. The regeneration, however, does not agree with the ontogeny. In both ontogeny and regeneration there is a close correlation between the two opercula, and each side has the potentiality of forming a functional operculum. When one side has a lead in development at the start it restricts the other to a rudimentary condition. When both have an equal start two functional opercula develop. A similar close relation between organs is shown in other cases. In the serpulid *Apomatus* after removal of the branchiæ and opercula, the differentiation of the new opercula is much more rapid when the posterior region of the body is also cut off than when this region is uninjured. In the decapod crustaceans *Gelasimus* and *Alpheus*, when both chelæ are thrown off the animals pass through the succeeding molts sooner than when no chelæ, or only one, is removed. Finally, in the ophiurid *Ophioglypha,* the rate of regeneration of the arms is greater the greater the number of removed arms, with the exception of the case where all are removed.

Iridescent Feathers: R. M. STRONG, Chicago, Ill.

**Study of Cross-sectional Courses through the Brain with Cortex Surface Relations by Aid of Fuller Sections and Models:* CHARLES H. HUGHES, St. Louis. (Read by title.) To be published in *The Alienist and Neurologist.*

The Morphology of the Vertebrate Head from the View-point of the Functional

Divisions of the Nervous System: J. B. Johnston, University of West Virginia. (Read by title.) To be printed in the *Journal of Comparative Neurology and Psychology.*

The Vascular System and Blood Flow in Diplocardia communis Garman: Frank Smith and J. T. Barrett.

Diplocardia communis is a species of large earthworms that are abundant in Illinois and that have a vascular system which may be profitably studied for the light thrown on disputed points concerning the blood flow of other species. Posterior to VI. the dorsal vessel is double in each somite. In IX. to XIV. there is a distinct supra-intestinal vessel which at its extremities joins the vascular plexus of the œsophageal wall and is connected with it by several short branches in each of the somites X., XI. and XII. There is nothing peculiar about the ventral vessel. A subneural and lateral-neurals are absent. A pair of lateral-longitudinal vessels connects anterior capillaries with the œsophageal plexus of somites IX. to XIII. inclusive. From it they extend outward to the body wall and posteriorly along the latter in the clitellar regions (XIII.–XVIII.). Three pairs of dorso-intestinal hearts in X.–XII. force blood from the dorsal and supra-intestinal into the ventral. Paired dorsal hearts in V.–IX. force blood from the dorsal into the ventral. In each somite posterior to XX. one to three intestino-tegumentaries connect the intestinal wall with each dorso-tegumentary at points near the body wall. Observations of pulsations and of the results of clamping and cutting vessels have led to conclusions of which the following is a brief summary: In *D. communis* the blood flows anteriorly in the dorsal; anteriorly in the ventral in front of the hearts and posteriorly back of them; posteriorly in the lateral-longitudinals into the œsophageal plexus of IX.–XIII. and then partly into the supra-intestinal and partly to the clitellar regions. Blood flows outward from the ventral through ventro-tegumentaries to the body wall, nephridia, nerve cord; and through ventro-intestinals to the intestine. Blood flows into the dorsal from the intestine through the dorso-intestinals and from the body wall, nephridia, etc., through the dorso-tegumentaries. Through the intestino-tegumentaries blood flows from the integument to the intestinal wall. These results closely accord with those of Johnston and Johnson on *Lumbricus terrestris* as far as the vessels correspond, and differ materially from those of other observers on that and other species.

**The Diffusion of North American Hawk Moths:* F. M. Webster, Urbana, Illinois.

The paper shows the probable northern trend of diffusion from the tropics through the Antilles into Florida, and through Central America and Mexico into the southwestern and Pacific Coast states, or from Honduras into the West Indies and thence to Florida, and their diffusion from these points of entrance into the United States over North America.

**Insect Life above Timber Line in Colorado and Arizona:* Francis H. Snow, Lawrence, Kansas. To be published in the *Kansas University Science Bulletin.*

This paper calls attention to the difference in the character of insect life in the two locations. In Colorado the species above timber are generally peculiar and, for the most part, not found below timber line. In Arizona the species above timber line do not differ from those below timber line. Illustrations are given. The reason suggested is that the glacial ice mass did not extend to the Arizona summits.

**The Salmonidæ and Thymallidæ of Alaska:* Barton Warren Evermann, Washington, D. C. (Read by title.)

The total number of species of Salmonidæ now known from Alaskan waters is 17, distributed among genera as follows: *Coregonus,* 3; *Argyrosomus,* 3; *Stenodus,* 1; *Oncorhynchus,* 5; *Salmo,* 3; *Cristivomer,* 1, and *Salvelinus* 1. Of the closely related family of Thymallidæ there is one species, *Thymallus signifer.* This number is much greater than is known from any other region; and as regards the number of individuals of important species of Salmonidæ, there is no other region that approaches Alaska. The Pacific salmons (of the genus *Oncorhynchus*) are by far the most abundant, one or more of the five species literally swarming in every suitable stream at spawning time. These are all anadromous fishes, spending the greater part of their lives in salt water, entering fresh-water streams only for spawning purposes. Immediately after spawning all the individuals of Pacific salmon, of whatever species, die, none surviving the spawning act and none ever returning to the sea. The eggs do not hatch until several weeks or even months after the fish that produced them have died, and, therefore, no Pacific salmon ever saw either its offspring or its parents; the generations never overlap. While many of the facts in the life histories of these salmon are now well known, there are many others which remain to be worked out. The Bureau of Fisheries is now taking steps looking towards a careful and thorough study of the salmon streams of Alaska and the life histories of the various species of salmon. During the recent investigations of the Alaska Salmon Commission many important facts were determined regarding these fishes. Much new information was secured regarding the habits and distribution of the Dolly Varden trout and the cut-throat trout, and the presence of a species of rainbow trout in southeast Alaska was first made known. A fine series of specimens of the fishes of the upper Yukon, including the Arctic grayling, was also secured.

**Preliminary Description of a New Family of Gymnoblastic Hydroids from the Hawaiian Islands:* C. C. NUTTING, University of Iowa. To be published in connection with a report on the hydroids of the Hawaiian cruise of the *Albatross,* U. S. Bureau of Fisheries.

The Development and Relationships of the Rugosa (Tetracoralla): J. E. DUERDEN, University of Michigan.

The paper gives: (1) A brief historical account of the various theories which have been held with regard to the nature and relationships of the extinct group of corals, the Rugosa or Tetracoralla; (2) the conclusions of the author from the examination of a large number of species in the light of more recent results on living Zoantharia. At different times the Rugosa have been supposed to be related to the Hydrozoa, Ceriantheæ, Alcyonaria, Scyphomedusæ and modern hexameral corals. The last view prevails mostly among English writers, the distinctness of the group being maintained by most German and French authors. The present investigations have been carried on mainly by the method of grinding down of individual coralla, each successive stage in the growth being drawn as it appeared. In this way the complete development and relationships of the septa have been established. In every instance where the perfect tip has been preserved a cycle of six septa is found to occur, thus demonstrating the primary hexameral relationships of the Rugosa as contrasted with the tetrameral usually assumed. The subsequent septa appear in only four of the six primary chambers and in a manner differing altogether from that in modern corals. The conclusions reached are that the Rugosa must remain as a distinct group of the Zoantharia, related in their proto-

septal stage to modern corals and actinians, but later developing in an altogether characteristic manner. Of modern forms they are most closely allied to the zoanthids, which are without any true skeleton; in these the growth of the mesenteries takes place in a manner comparable to that of the septa in the extinct forms, though proceeding in only two of the six primary chambers.

Demonstration of Preparations made during a Study of the Life-history of the Cestode Crossobothrium laciniatum (Linton): W. C. Curtis, University of Missouri.

**The Types of Limb Structure in the Triassic Ichthyosaurs:* John C. Merriam, Berkeley, California. To be printed in *American Journal of Science.*

The limb structure in the Triassic ichthyosaurs shows generally a much stronger resemblance to the type of extremity found in the primitive shore forms of the reptilia than is seen in the Jurassic forms. The limbs of Triassic ichthyosaurs show as great a degree of differentiation as is found in the later types. Two fairly definite lines of evolution are noticeable in the paddle structure of the Ichthyosauria, one leading to the broad-paddled Latipinnati, the other leading to the Californian Triassic genera and to the narrow-paddled Longipinnati.

**A New Group of Marine Reptiles from the Upper Triassic of California:* John C. Merriam, Berkeley, California. To be printed in 'Publications' of the University of California.

Marine saurians with abbreviated limbs and slender, elongated snout. External nares median. Temporal arcades slender. Dentition heterodont, posterior teeth flat, anterior teeth slender, conical. Elongated vomer with two rows of flat teeth. Pterygoid (?) with numerous slender conical teeth. This group stands in somewhat the same relation to the typical Rhynchocephalia as that which the Pythonomorpha bear to the Lacertilia. Evidently derived from primitive land or shore rhynchocephalians, it has taken somewhat the same course in evolution as that followed by the ichthyosaurians and parasuchians. From both of these groups it differs very considerably in the structure of the vertebræ, limbs and skull. It is sharply separated from both by the characters of dentition. The name Thalattosauria has been used to designate this group.

An Anomaly in the Arterial System of the Dog: John C. Brown. (Introduced by H. F. Nachtrieb.)

The right subclavian artery arises from the dorsal aorta beyond the origin of the left subclavian artery and passes dorsad to the œsophagus and trachea before reaching the right fore limb. The right fourth branchial arch is entirely wanting.

The Brain and Nerve Cord of Placobdella pediculata: Illustrated by wax models made after the Born method by E. E. Hemingway. (Presented by Professor Henry F. Nachtrieb.)

Placobdella pediculata Moore is a new species of leech parasitic in the gill chambers of the sheepshead. The description of this leech has not yet been published, but will appear in connection with Mr. Hemingway's account of the anatomy of the animal. In general the results of Mr. Hemingway's work confirm the conclusions reached by Whitman for *Clepsine hollensis* and other species. The models represented the brain, the ganglion of a typical somite and the posterior mass of ganglia.

The Mechanism of Feeding and Breathing in the Lamprey: Jean Dawson, University of Michigan. (Presented by Jacob Reighard.)

It was shown that there is no good evidence that lampreys feed except when attached, and that, according to accepted accounts, they breathe when free as when attached, through the external branchiopores. There is thus apparently no occasion for a backward current of water into the mouth, either for the purposes of respiration or for the purpose of feeding, and the published observations and those of the writer show that such a current is of rare occurrence. It would thus appear that the velar valves, water tube and valves of the external branchiopore must serve chiefly for the purpose of enabling a current of water to be directed forward out of the mouth. It was shown that such a current is directed forward whenever the animal cleanses the pharynx or mouth of irritating foreign bodies and whenever it detaches itself. Synchronously with the forwardly directed current there is a closure of the external branchiopore by means of the ectal and ental valves described by Gage. Hence water tube, velar valves and ectal and ental valves of Gage find their explanation chiefly in this forwardly directed current. There was also described a pair of jaws—the velar jaws, connected with the velar valves. These jaws serve to hinder the entrance of foreign bodies into the water tube, and are so arranged as to close when the water tube closes by the action of the velar valves, and to open when the water tube opens through the relaxation of the velar valves. It was shown further that the attached lamprey feeds not only on the blood of its host (as stated by Gage), but also on its soft tissues.

**Some Reactions of Mnemiopsis leidyi:* GEORGE WILLIAM HUNTER, JR., New York City. (Read by title.)

Geotropism.—The animal becomes positively or negatively geotropic under conditions seemingly intimately associated with the given supply of light and degree of temperature. *Stereotropism.*—*Mnemiopsis* exhibits marked stereotropism, especially in the darkness. Large numbers of animals will frequently be found resting in pockets in the eel-grass. They also exhibit this same phenomenon in dishes in the laboratory. *Reactions to Light (Phototaxis and Photopathy).*—Sudden light causes activity; sudden darkness inhibits activity. (This is partly in harmony with the findings of Yerkes on *Gonionemus.* See *American Journal of Physiology,* IX., No. 5.) Orientation with reference to the directive influence of the light rays (phototaxis) was long sought for, but only obtained in a few instances, with very strong or focused sunlight. A large number of experiments were made in dishes covered with strips of red, blue and green glass. It was found that in a given period of time (one to ten hours, observations made every half hour) the greater number of animals were counted under the green glass. The totals from 5 sets of experiments read as follows: Blue, 90; red, 126; green, 235. These results need much more careful study before an explanation is offered. *Effects of Changes in Temperature.*—*Mnemiopsis* is relatively more resistant to changes in temperature than is *Gonionemus* (see Yerkes, *American Journal of Physiology,* Vol. IX., No. 5). Responses to electrical stimulation under condition of decrease of heat show little change in reaction time to 15° C.; lower than that a gradual increase in reaction time until no reaction is reached. Responses to electrical stimulation under conditions of increase of temperature show a slight quickening in the reaction time up to about 29° C. After that a rapid increase in reaction time. *Electrotaxis.*—A definite orientation of the animal is the immediate effect of stimulation with a current of moderate strength (one half to three volts, voltage taken in

dish of water about one inch from the electrode). The body is turned so that the long axis comes to lie approximately in the direction of the current, the aboral end is directed toward the anode, and the animal moves with more or less rapidity (depending upon the strength of the current) to the cathode. With a very weak current the animal may simply orient itself without movement towards the cathode. Still weaker stimulation may simply cause slight muscular contraction and movement of cilia without orientation. Reversal of current causes reversal in the orientation of the animal and reversal in the direction of its progression. The immediate cause of the change in direction of the animal is a reversal in the direction of the beat of the ciliated paddle-plates. In general, these may be said to beat more strongly in the direction of the anode. But orientation is brought about by more vigorous beating of the plates in certain regions of the body—possibly more strongly in the more direct lines of current. Muscular action also aids in orientation and in locomotion. Observations on the action of cilia and muscles under the induced current were also made, but are too incomplete for present notice.

**Mouth Parts and Oviposition of Gall-producing Insects:* MEL. T. COOK, De Pauw University.

Gall-producing insects have two methods of depositing eggs, *i. e.,* on the surface of the plant and within the tissues. In the case of the hymenopterous insects, the eggs are placed within the tissues of the bud, the incipient shoot or in the undeveloped leaves of the bud. There is no indication of chemical stimulus. The gall forms after the hatching of the larva and is probably due to the stimulus from the mouth parts of the larva. The mouth parts are of two forms, those for sucking and those for biting. The strength of the mandibles varies with the firmness of the gall. The stimulus is due to mechanical irritation.

**The Bermuda Biological Station for Research:* E. L. MARK, Harvard University.

**A Theory of the Histogenesis, Constitution and Physiological State of Peripheral Nerve:* PORTER E. SARGENT, Cambridge, Massachusetts. (Read by title.) To be published in the *Journal of Comparative Neurology and Psychology.*

**The Two Chief Faunæ of the Earth:* ALPHEUS S. PACKARD, Brown University. (Read by title.)

From the recent studies on the distribution of several groups of moths, I have been led to review the recent work and views of those who advocate the former connection between South America and Africa, and the possible connection of the southern land-masses with Antarctic land. There seem to be two main centers of origin, *i. e.,* two chief zoological areas—that of the northern and that of the southern continents. To the former Huxley's name, Arctogæa, is by general consent applied. For the southern area Sclater's name, Antarctogæa, may be employed. Indeed, we had thought of this term before learning that the name had already been suggested. Although Gadow extends the term Notogæa so as to embrace the three southern continents, yet it seems preferable to confine it to its former limits. The Antarctogæan area thus includes what are regarded by Blandford, Lydekker and others as two separate realms, *i. e.,* Neogæa (South and Central America) and Notogæa (Australasia, Polynesia and Austro-Malaysia), while Africa south of the Sahara was regarded as a region or dependence of Arctogæa. The opinion, however, that the form and distribution of the continents were very different in past ages from what they are now is gaining ground. Thus northeastern America and western

and central Europe seem to have been more or less connected during and since the Cambrian period, with intermigrations of life-forms. This connection, with probable interruptions, appears to have continued down to the early centuries of the Quarternary. Also, from what little we know of the extinct animals and of the present relations of the plants and animals of the continents south of latitude 20° north, several observers have been led to suppose that these continents were more or less intimately united, and that possibly there were land connections with a former Antarctic continent. From maps, though naturally very hypothetical, published by de Lapparent and Koken, showing the probable distribution of land during the Middle Devonian, South America, Africa, southern Asia and Australia were possibly connected. Towards the end of the Carboniferous period there was probably a more or less continuous extent of land over what is now South America, Africa and Australia. This land connection between what are now separate continents appears to have persisted through the early Mesozoic age (Trias and Jura), though towards the end of the Jurassic Australia became widely separated by the Indian Ocean from Africa, while South America and Africa remained united. Our studies on the distribution of Neogæic and African (Ethiopian) Ceratocampidæ and two related families point to a connection in Cretaceous or early Tertiary times between Brazil and western Africa, thus bearing out the views of Ihering, Gill, Ortmann and others. The former connection of these Antarctogæic continents (whatever may be said of their possible connection with Antarctica) is borne out by the well-known facts in the distribution of certain terrestrial worms, land and fresh-water mollusks, insects, fresh-water fish, Dipnoi, *Peripatus*, amphibians, reptiles, birds and mammals. Our results also suggest that Africa south of the Sahara should properly be regarded as a zoological realm (for which the word Afrogæa is proposed), and not a dependence or region of Arctogæa.

C. JUDSON HERRICK,
Secretary.

AMERICAN SOCIETY OF ZOOLOGISTS, CENTRAL BRANCH.

THE first annual meeting under the present organization was held at St. Louis, December 29 and 30. The following officers were elected for the ensuing year:

President—Professor C. H. Eigenmann.
Vice-President—Dr. S. J. Holmes.
Secretary and Treasurer—Professor F. R. Lillie.
Additional Members of the Executive Committee—One year, Professor G. A. Lefevre; two years, Professor T. G. Lee; three years, Professor Herbert Osborn.

The titles and abstracts of the papers presented appear together with those presented by Section F of the American Association for the Advancement of Science, in Professor Herrick's report printed above.

FRANK SMITH,
Secretary.

SCIENTIFIC BOOKS.

Evolution and Adaptation. By THOMAS HUNT MORGAN. The Macmillan Company. 1903. Pp. 470.

The modern evolutionist is obliged to confess, and somewhat painfully, that the processes connected with 'Darwinism' continue to receive different and conflicting explanations—this, too, in the face of a mass of documents which an ever-increasing number of investigators have been bringing together during the past decades. In token of this lack of concord in interpretation witness two volumes, not mere tracts, which have lately appeared. In the first of these, Plate,* following Darwinian

* 'Ueber die Bedeutung des Darwin'schen Selectionsprincips und Probleme der Artbildung,' Zweite, vermehrte Auflage, 1903, Engelmann, pp. 247.