ordinary winds. The winds are so ubiquitous and so incessantly in motion that their aggregate geologic work is by no means negligible, though it may be momentarily inappreciable. If the winds are constantly carrying material they must be carrying some of it to sea, and of this the major part will be deposited in the ocean and only a small fraction returned to the land. Land breezes are notoriously dusty, and that the winds blowing inward from the ocean are much more free from solid contamination is known, not only deductively and from general observation, but as the result of actual counts of the dust particles.[2]

Udden[3] has calculated on very conservative data that the transport capacity of the winds blowing outward from the Mississippi Basin is at least one thousand times greater than that of the river. This, of course, refers only to transport *capacity,* and no one imagines that the actual amounts of material moved are in the same ratio. The air, unlike the water, is seldom loaded to any considerable fraction of its capacity. It is evident, however, that if the wind performs only an infinitesimal part of the carriage for which it has the ability, its activity is nevertheless far too great to be neglected. Neither is the Mississippi Basin a region especially susceptible to æolian action. The immense amount of wind-borne material carried out of deserts is universally admitted, and the example of the sirocco dust which constantly leaves the Sahara for the Atlantic to the west and the Mediterranean to the north is universally familiar.

From the information at present available it is entirely impossible to estimate with accuracy the yearly rate of æolian removal or the resultant error in the calculations of the rapidity of denudation. It seems, however, not improbable that the error is of some moment and that the present estimates are too low in a not unimportant degree, even when their admittedly approximate character is taken into account. These conclusions derive added force from two recent papers by Thoulet[4] in which he records his conviction that a considerable fraction of the mud of the sea bottom is terrestrial dust borne to its position by winds and fallen through the overlying water in an approximately vertical path.

E. E. Free

Bureau of Soils,
U. S. Department of Agriculture

[2] Aitkin, *Trans. Roy. Soc. Edinb.*, 42: 486, 1902.

[3] *Jour. Geol.*, 2: 318–331, 1894.

[4] *Comptes Rendus*, 146: 1184–1186, 1346–1349, 1908.

THE AMERICAN SOCIETY OF ZOOLOGISTS

The regular triennial joint meeting of the Eastern and Central Branches of the American Society of Zoologists was held at the Johns Hopkins University, Baltimore, Md., on December 29, 30 and 31, 1908.

The following resolutions were adopted:

Resolved, That this society most urgently recommends to the Committee on Ways and Means, or other body having the matter in charge, that the present duty on scientific books published in English, and on scientific apparatus be removed.

Resolved, That, in the opinion of this society, the migratory birds of the United States should be properly protected by national laws, and that this society urges immediate consideration of the bill, introduced by Representative Weeks, now before Congress.

The officers elected were:

EASTERN BRANCH

President—Herbert S. Jennings, Johns Hopkins University.

Vice-president—H. V. Wilson, University of North Carolina.

Secretary-Treasurer—Lorande Loss Woodruff, Yale University.

Additional Member of Executive Committee—Maynard M. Metcalf, Oberlin College.

CENTRAL BRANCH

President—Edward A. Birge, University of Wisconsin.

Vice-president—Michael F. Guyer, University of Cincinnati.

Secretary-Treasurer—Charles Zeleny, University of Indiana.

The following papers were presented:

Diverse Races of Paramecium and their Relation to Selection and to Conjugation: H. S. Jennings, Johns Hopkins University.

"Wild" cultures of *Paramecium* were found to consist of many diverse races, which remain constant in relative mean size when propagated in "pure lines," by fission. Eight such differing "pure lines" were isolated and propagated side by side under the same conditions for many months. The smallest race had a mean length below 100 microns; the largest a mean length above 200 microns. Most existing races fall into two groups: (1) those with mean length above 170 microns; (2) those with mean below 140 microns. The former group corresponds to what has been described as the species *caudatum*, the latter to *aurelia*. A single race falling half-way between the two groups was found; such races are rare.

Within the pure race there is much variation due to environmental conditions and to growth, but such variations are not inherited. Large and small individuals of the same race produce progeny of the same mean size, so that the characteristics of the progeny depend on the fundamental constitution of the race, not on the individual peculiarities of the parent. It is not possible to produce by long continued selection diverse races from a single race.

The diverse races retain their relative sizes throughout the life cycle, including conjugation. Owing to the assortative mating described by Pearl, there is a tendency for the diverse races to remain isolated even when conjugation occurs.

The Reactions of Didinium nasutum with Special Reference to the Feeding Habits and the Functions of Trichocysts: S. O. MAST, Woman's College of Baltimore.

Light Reactions in Euglena and Stentor cœruleus: S. O. MAST, Woman's College of Baltimore.

Notes on Opalina: MAYNARD M. METCALF, Oberlin College.

A paper describing the phenomena to which these notes refer will appear in the *Archiv f. Protistenkunde*, Bd. XIII., Heft 3.

The Measurement of Relative Toxicity and of Differences of Physiological State by the Use of Protozoa: A. W. PETERS, University of Illinois.

Selection of Food in Stentor cœruleus: ASA A. SCHAEFFER, Johns Hopkins University.

From a capillary pipette, potato starch grains, particles of sand, bits of débris, *Euglena viridis*, *Phacus triqueter*, *Trachelomonas volvocina*, etc., were fed in mixed order, on to the disk of a *Stentor*. The path and fate of each particle was recorded. The starch, sand and débris were almost invariably rejected, while the organisms, either freshly killed or living, were invariably ingested. When the *Stentor* became more and more filled up, more and more of the organisms were rejected, until eventually all organisms, as well as all starch, sand, etc., were rejected.

In some experiments it was shown that some organisms are eaten while others are not; thus in a stream of *Euglena viridis* and *Trachelomonas volvocina*, fed in mixed order, although both kinds of organisms were eaten at the beginning of the experiment, the *Stentor* ate only *Euglena* in the latter part of the experiment, rejecting all *Trachelomonas* and also some *Euglena*.

Thus *Stentor* can "select" food particles from a stream containing food and non-food particles. Further, *Stentor* can "select" one kind of food from a mixture of several different kinds, such as *Euglena* from *Trachelomonas*, etc.; and it is highly probable that *Stentor*, when nearly replete, "selects" certain individuals to the exclusion of others, of the same species.

Selection can be explained upon purely objective grounds as determined by the action of the stimulus in the particle upon the ingesting mechanism (including the varying physiologic state) of *Stentor*.

Duration of the Cycle of Paramecium: LORANDE LOSS WOODRUFF, Yale University.

A culture of *Paramecium* has been carried on a varied culture medium for twenty months, during which time 930 generations have been attained. Conjugation has been prevented by the daily isolation of individuals, and no artificial stimulation has been employed. "Abnormal" physiological or morphological changes have not appeared in the specimens.

Effects of Centrifugal Force on the Organization and Development of the Eggs of Ascidians and Mollusks: E. G. CONKLIN, Princeton University.

The Organization of the Egg of a Medusa: E. G. CONKLIN, Princeton University.

The Oogenesis of Cumingia tellinoides (Conrad): H. E. JORDAN, University of Virginia.

The primary oocyte at the beginning of the growth period has a nucleus of three microns diameter. The nuclear reticulum is achromatic except for a large eccentric nucleolus. At slightly later stages chromatic masses appear in the nucleus and are generally arranged in pairs. Such pairs probably represent presynoptic bivalent chromosomes. The arrangement of the chromosomes indicates parasynapsis. Still later in the

growth period the chromosomes become aggregated into a mass and the latter assumes a more or less close connection with the nucleolus. Both nucleolus and chromosome-mass are typically close to the nuclear wall. Maturation proceeds to the metaphase in the ovarian egg. A single instance was observed where the mitosis had passed to anaphase. The later phases of maturation occur only after the egg is extruded and fertilized. The nucleolus disappears during the metaphase of the first maturation mitosis. It seems to contribute a small amount of chromatin to the chromosomes, after which its main bulk is resorbed by the cytoplasm. The nucleolus appears to be of the nature of reserve food material rather than a waste product.

The astral system of the first mitosis consists of a large, very chromatic centrosome surrounded by a homogeneous acroplasmic centrosphere which is bounded by a "microsome circle" and an outlying astrosphere. Between metaphase and anaphase in the free eggs the centrosome disappears. The centrosphere of the second polar spindle, as also of the fertilization and early segmentation spindles, is achromatic and granular. The centrosome appears to be merely an accompaniment of the astral system, representing a transient metabolic phase of maturation coincident with the formation of the first polar spindle. The reduced number of chromosomes is eighteen. The second mitosis segments univalent chromosomes transversely and is the reducing division.

The Germ-cell Determinants of Chrysomelid Beetles: R. W. Hegner, University of Michigan.

The Germ-cell Determinants.—This paper is based on the study of the lineage of the germ-cells of *Calligrapha multipunctata* and three other chrysomelid beetles. At the time of laying a disc-shaped mass of granules is present at the posterior end of the egg suspended in the peripheral layer of cytoplasm. I have called this disc the "pole-disc" and the granules the "germ-cell determinants." The cleavage products in the eggs of these beetles migrate through the central yolk mass to the periphery, where they produce the blastoderm. Those cleavage products that come in contact with the germ-cell determinants do not produce blastoderm cells, but continue their migration until they are entirely separated from the egg. These cells take with them practically all of the germ-cell determinants. At first there are 16 of these cells, but they soon divide twice, the final number being 64. These are the primordial germ-cells. They can be traced back into the embryo, where by amœboid movements they migrate half to either side of the germ-band. Later they produce the germ-glands. The sexes can be distinguished during the embryonic period by the shape of the germ-glands.

The Results of Removing the Germ-cell Determinants.—A number of fresh eggs were punctured and the germ-cell determinants allowed to flow out. These eggs developed into embryos or larvæ which contained no germ-cells.

The Sexual Differences of the Chromosome Groups in Pyrrochoris and Syromastes: Edmund B. Wilson, Columbia University.

The facts in *Pyrrochoris* and *Syromastes* have been supposed to contradict the general rule, established for many other forms, that those spermatozoa which receive the accessory chromosome are female-producing, the others male-producing; for in both cases the two sexes have been described as having the same number of chromosomes—24 in *Pyrrochoris* and 22 in *Syromastes*. A reexamination of both sexes in the two forms has proved that they form no exception to the rule, previously published accounts being erroneous in respect to the male of *Pyrrochoris* and the female of *Syromastes*.

In *Pyrrochoris* the male number is not 24, but 23, the odd or accessory chromosome being the largest of the chromosomes. Half the spermatozoa receive this chromosome and half fail to receive it, the former class having 12 chromosomes and the latter 11. The female groups contain 24 chromosomes, of which two are of the same relative size as the single accessory of the male. *Pyrrochoris*, therefore, conforms precisely to the usual type shown in *Anasa*, *Protenor*, etc.

In *Syromastes* the male number is 22 (as described by Gross), but the female number is not 22, but 24, as was first inferred by the writer from the condition seen in the male only. Direct observation has now proved that this inference was correct. *Syromastes* constitutes a new type in which there are two accessory chromosomes (the second and third smallest of the spermatogonial groups) which pass together, as a bivalent, into half the spermatozoa. These spermatozoa receive 12 chromosomes, the others 10, and the somatic numbers of the sexes prove that the former class are female-producing, the latter male-producing. (Demonstrations by photographs.)

Some New Types of Chromosome Distribution and Their Relation to Sex: Fernandus Payne, Columbia University.

A study of *Gelastocoris* and the Reduviidæ has revealed several new types of chromosome distribution.

There is present in *Diplodus* and several other species of the Reduviidæ a pair of idiochromosomes, which in the new types is replaced by a compound group. Each of these groups as a whole behaves as a pair of idiochromosomes, the small idiochromosome being represented by one element and the large idiochromosome by a multiple group. In *Fitchia* the multiple group consists of two; in *Prionidus*, three; in *Gelastocoris*, four; and in *Acholla multispinosa* (identified by E. P. Van Duzee) of five chromosomes. This multiple group in the second maturation division always passes to one pole and the single element the other, thus producing in each case two classes of spermatozoa.

The male and female chromosome groups are, respectively, 27 and 28 in *Fitchia;* 26 and 28 in *Prionidus;* 35 and 38 in *Gelastocoris;* and 26 and 30 in *Acholla*. Judging from these numerical relations the two classes of spermatozoa must be male and female producing.

It seems very probable that the new types have arisen from the idiochromosome type by the large idiochromosome breaking up into a number of elements.

These new types of chromosome distribution offer nothing new to the theory of sex-production as advocated by Wilson ('06) and Stevens ('06), but they are perfectly consistent with it.

In *Acholla multispinosa,* although the female has the larger number of chromosomes, the male seems to have the greater quantity of chromatin.

Sex Determination and Parthenogenesis in Phylloxerans and Aphids: T. H. MORGAN, Columbia University. (See SCIENCE, 1909.)

Maturation, Fertilization and Cleavage of Tubularia crocea and Pennaria tiarella: GEO. T. HARGITT.

During the period between the end of the growth of the egg and the formation of the polar bodies the large nucleolus disappears, a concentration of the chromatin occurs, the nucleus decreases in size and becomes ovoid in shape. At the pointed outer end only, in the nucleus of *Tubularia*, an aster without a centrosome is usually present for a considerable time. The fate of this aster is not known.

Polar bodies are formed by mitosis. No asters or centrosomes are present in the first polar spindle, so far the only one actually observed. In *Tubularia* two polar bodies are formed. In the first polar spindle of *Pennaria* apparently only about one half of the somatic number of chromosomes is present, though the actual number is still uncertain. In *Pennaria* the time of formation of the polar bodies varies considerably, some eggs passing through this stage just before fertilization, and some several hours before the liberation of the eggs from the medusæ.

In *Pennaria* spermatozoa may enter the egg at any point, though usually close to the position of the egg nucleus. The transformation into the sperm nucleus takes place just within the edge of the egg, before migration toward the egg nucleus begins. One or both of the pronuclei are often multi-vesiculate, at least up to the time of conjugation. No asters or radiations of any sort are present during the conjugation of the pronuclei.

Segmentation seems to be always by mitosis and cytoplasmic division is often delayed until several nuclei are present.

Early Development of the Spider's Egg: THOS. H. MONTGOMERY, JR.

The gastrulation takes place from an anterior and a posterior cumulus, and from the margins of the germ disc; vitellocytes form at all these regions, mesoblast and entoblast only from the anterior cumulus. The vitellocytes take no part in producing the intestine. Entoblast develops only in the abdomen. The blood cells arise from the extraembryonic ectoblast, and migrate secondarily into the embryo. One pair of cœlomic sacs develops anterior to the mouth, and the rostral prominences are to be considered prestomial appendages of this head segment; there is no evidence of other preoral appendages. Pulmonary lamellæ appear before the pulmonary appendages invaginate, and upon these. The supraœsophageal ganglion is a fusion of one pair of cerebral ridges, and a pair of antero-lateral and a pair of postero-lateral vesicles, all local differentiations of the single head lobe.

The Formation of the Mouth Opening and the Limits of the Ectoderm and Entoderm in the Mouth of Amphibians: J. B. JOHNSTON.

The Post-anal Gut and its Relation to the Doctrine of Recapitulation: BASHFORD DEAN, Columbia University.

It was pointed out that the general value of the "biogenetic law," now often discredited, might be tested by paleontological documents, even in the case of structures whose nature rendered them poor subjects for fossilization. This Dr. Dean illustrated in the case of the post-anal gut in the embryos of fishes, giving reasons to show that the post-

anal was a functional gut in the adult of certain Devonian sharks. In these forms (Cladoselachids) the anal fin was paired, its elements converging at the base of the tail, where the cloaca was accordingly located. The sub-caudal position of the cloaca is, moreover, indicated by the position of the kidneys. These are now known, both by macroscopic and histological characters in these fossils to have continued behind the ventral fins and converged near the tail.

The Cause of Pulsation in Scyphomedusæ: Alfred Goldsborough Mayer, Carnegie Institution of Washington.

In the case of *Cassiopea xamachana* the sodium chloride of the sea water is a powerful stimulant to the nervous system, but its tendency in this direction is exactly offset and counteracted by the inhibiting influences of the magnesium, calcium and potassium. Thus the sea water as a whole is a balanced fluid, and neither stimulates nor inhibits the pulsation of the medusa.

The stimulus which causes pulsation is due to a slight but constantly maintained excess of sodium chloride over and above its concentration in the sea water. This excess of sodium chloride is engendered in the distal endodermal cells of the marginal sense-organs, which constantly give rise to sodium oxalate. This oxalate precipitates the calcium chloride and sulphate which enter the sense-club from the surrounding sea water, and forms the calcic oxalate crystals of the sense-club, thus setting free sodium chloride and sulphate, which act as powerful nervous stimulants to which the nervous elements respond periodically.

The stimulus-producing pulsation is thus wholly internal, not due to external agencies. It has been commonly supposed that the crystalline concretions in the sense-clubs of scyphomedusæ were calcium carbonate, but I find upon chemical analysis that they are oxalates.

The Sense of Hearing in the Dogfish: G. H. Parker, Harvard University.

If the side of a large wooden aquarium in which a dogfish (*Mustelus canis*) is swimming quietly is struck a vigorous blow, the dogfish will react by a quivering motion, especially of the posterior edges of the pectoral fins. By the use of a heavy pendulum the momentum with which a given blow was struck could be determined. The momentum of the minimum blow to which normal fishes reacted was arbitrarily called unity. After the eighth nerves were cut a blow with a momentum three or four times that just mentioned was needed to produce a reaction. This response was believed to be due to the mechanical stimulation of the skin. After the skin of a normal fish had been rendered insensitive by cutting the fifth, seventh and lateral line nerves, and by cocaining the pectoral regions, a step not taken in previous experiments, the fish was found to be as sensitive to sounds as a normal fish is. This sensitiveness entirely disappeared when in addition to the operations already carried out on the fish, the eighth nerves were cut. Sounds affect both the skin and the ears of the dogfish and the latter organs are the more sensitive of the two.

Regulation in the Morphogenetic Activity of the Oviduct of the Hen: Raymond Pearl, Maine Agricultural Experiment Station.

This paper gives an account of a case in which a gradual change in the shape of eggs successively laid by the same bird occurred. This change in the shape of the eggs is (1) referable to a change in the activity of the oviduct, (2) definitely progressive and (3) regulatory in character, since it proceeds from the abnormal to the normal. The first egg laid by a particular Barred Plymouth Rock pullet (No. 183) was strikingly abnormal in shape (long and narrow). Every egg laid by this bird was saved and measured. As eggs were successively laid there was a gradual change in shape from the abnormal condition found in the first eggs to a substantially normal condition.

The change in the shape of the eggs was found to follow a logarithmic curve, of the type seen in growth curves.

The Nature of the Stimulus which Causes a Shell to be Formed on a Bird's Egg: Raymond Pearl and Frank M. Surface, Maine Agricultural Experiment Station.

This investigation was undertaken to determine precisely what is the nature of the stimulus which excites the reflex activity of the shell-secreting glands of the oviduct in birds. These possibilities were to be considered:

1. That the stimulus is mechanical, and arises from the presence of a soft body (the egg) within the "uterus" or "shell gland."

2. That the stimulus is chemical in nature.

3. That the activity of the shell-secreting apparatus is controlled directly by the functioning of other parts of the reproductive system.

If shell formation is caused from the mechanical stimulation of the "shell gland" by the egg it would be expected that any foreign body introduced into that portion of the oviduct would have a shell formed around it. It was found to be impossible to introduce a foreign body of any size

from the outside into the "shell gland" without resort to such violent methods as to make the conditions entirely abnormal. Further, the foreign body introduced should approximate to the consistency of the egg, so that the stimulus may be physiological rather than traumatic.

To realize these conditions the following operation was performed on hens. The oviduct was transected 1 or 2 cm. above the upper end of the "shell gland." The anterior portion of the oviduct was then ligated. The intestine was transected just anterior to the cloaca and the cloacal wall repaired by inversion of the stump and a purse string suture. Then the cut end of the intestine was anastomosed to the cut end of the oviduct ("shell gland"). As a result of this operation the feces must necessarily pass through the "shell gland" on the way to the cloaca. *In hens on which this operation has been performed a calcareous shell is deposited on the feces during their passage through the shell gland.* The results obtained from these experiments are held to warrant the following conclusions:

1. The stimulus which sets the shell-secreting glands of the fowl's oviduct into activity is mechanical rather than chemical in nature.

2. The formation of a shell on the hen's egg is brought about by a strictly local reflex, and is not immediately dependent upon the activity of other portions of the reproductive system (nervous impulse of hormone formation).

Experimental Control of Fission in Planaria: C. M. CHILD, University of Chicago.

The Artificial Production and the Development of One-eyed Monsters: CHARLES R. STOCKARD, Cornell Medical School.

The eggs of the fish, *Fundulus heteroclitus*, give rise to a large percentage of cyclopean embryos when subjected during their development to solutions of magnesium salts in sea water. These one-eyed embryos hatch and many of them swim in a perfectly normal manner, darting back and forth to avoid objects placed in their field of vision as readily as do two-eyed individuals.

The cyclopean fish is entirely comparable to the one-eyed human monsters. Both have a median eye more or less double in structure. The nose in the human cyclops is a proboscis-like mass above the eye. The nasal pits in the "magnesium embryos" are sometimes united and sometimes separate, but the mouth hangs ventrally as a proboscis-like organ, suggesting in form the nose in mammalian cyclopia.

The fish embryos exhibit various degrees of the cyclopean defect from eyes unusually close together to approximated eyes, double eyes and finally a single median eye. The different conditions are exhibited from the earliest appearance of the optic outpushings and in no case was cyclopia due to a union or fusion of the two eye components after they had originated separately.

A second type of monster, "monstrum monophthalmicum asymmetricum," was also common in the magnesium solutions. These individuals have one perfect eye of the normal pair but the other is either small, poorly represented or entirely absent. This condition is also present from the first appearance of eye structures and is not due to degeneration or arrest of development.

Both types of monsters often form well-differentiated crystalline lenses independently of a stimulus from the optic-cup.

The experiments conclusively prove that developing eggs may be induced to form cyclopean monsters by external influences which do not mechanically injure certain eye regions. Therefore, cyclopean monsters in nature are probably not due to germinal variations, but are far more likely the result of some unusual external influence during development.

Cosmobia; a Theory Concerning Certain Types of Monsters: H. H. WILDER, Smith College.

The readiness with which the types of double monsters may be arranged in related series has been recognized for some time, and this phase of the subject has been recently revived. To illustrate this, the main types of the Janus series were presented, beginning with a symmetrical Janus, passing through the different stages of gnathopagus, thoracopagus, etc., and ending with a type of duplicate twins in which the placenta alone is common, the other parts distinct. This leads to the definition of such twins as double monsters in which the common parts are confined to the extra-embryonal structures. These are lost at birth, freeing the components. The diprosopus group was treated in the same way. Attention was then called to the fact that in symmetrical monsters that are less than unity the doubled or compound parts, eyes, limbs, etc., are indistinguishable from those that are found in monsters that are on the other side of the normal, *i. e.*, the diplopagi. As a conclusion from this it seems that both classes of monsters are due to the same or a similar cause, and that normal individuals also belong in the same general series. To such individuals, both less and more than unity, including also normal forms, the term "*cosmobia*,"

or "orderly beings," may be applied. These forms are held to be due to some fundamental cause inherent in the germ itself, that is, in the egg or the embryo in the early cleavage stages, and must be carefully distinguished from all deformities or other monstrosities that are due to external or later developing causes, not germinal.

A Further Contribution on the Regenerative Power of the Somatic Cells of Sponges after Removal from the Parent: H. V. Wilson, University of North Carolina.

I have described (*Journ. Exper. Zool.*, Vol. V., No. 2) a method by which sponges, more particularly *Microciona*, may be made to regenerate from somatic cells. The sponge is cut into pieces and the pieces are strained under pressure through bolting cloth. The separated cells of the body pass through the pores of the cloth and collect as a sediment on the bottom of the dish. The sediment may be drawn up into a pipette and strewn over a glass slide or other object. The cells combine, forming a plasmodial structure which gradually differentiates into a functional sponge having pores, oscula, flagellated chambers and canals. It remained doubtful whether sponges grown in this way would live long enough to develop the characteristic skeleton. The experiments with *Microciona* have been repeated, and the regenerated sponges kept for two months. The characteristic species-skeleton was differentiated. Reproductive elements and embryos were also formed. The sponges appear to be healthy and to differ in no wise from normal specimens.

The Effects of Certain Paralyzing Agents on Form Regulation: C. M. Child, University of Chicago.

The Rate of Regeneration and the Effect of New Tissue on the Old Body: Charles R. Stockard, Cornell Medical School.

Regeneration takes place equally fast from the disk of *Cassiopea xamachana*, whether it be in periodic pulsation or in a condition of rest.

Peripheral pieces of the disk cut in sundry patterns show decided regulatory ability and tend to assume the original circular shape of the entire disk in the most direct way that their forms will permit. The attainment of the circular form inhibits the process of regeneration in the pieces, yet regeneration will continue for a much longer time if such shapes be prevented.

The rate of regeneration from a peripheral cut on the *Cassiopea* disk is faster the nearer the disk center the cut is made. In the brittle-stars *Ophiocoma riisei* and *O. echinata* new arms regenerate faster as the old arms are cut off nearer their base of attachment to the body-disk.

The rate of regeneration does not bear a definite relation to the extent of injury in all animal species. The medusa, *Cassiopea*, regenerates each oral-arm at a rate which is independent of the degree of injury when replacing either one, two, four or six of its arms. If, however, eight arms are amputated each arm regenerates at a rate significantly faster than the rate when injured to any less degree. *Ophiocoma riisei* regenerates one, two, three, four or all five of its arms at rates not significantly different. *O. echinata* grows individual arms fastest when only a single arm is regenerating and successively slower when two, three, four and five arms are being replaced.

Regenerating tissue possesses an excessive capacity for the absorption of nutriment and may do so even to the detriment of the old body tissue. The unfed disk of *Cassiopea* decreases in size in direct relation to the number of regenerating arms. Although the disk regenerating eight new arms is growing them at the most rapid rate, it is, nevertheless, decreasing in size most rapidly. In growing specimens of *Ophiocoma riisei* the increase in size is slower in those individuals regenerating many arms as compared with others regenerating fewer. *O. echinata* regenerates each arm faster when only a few arms are cut, such individuals increase in size at about the same rate as do those which are regenerating each arm slower although more arms are being replaced.

Successive Regenerations; New Observations and General Discussion: Charles Zeleny, University of Indiana.

The Physiology of Nematocysts: O. C. Glaser and C. M. Sparrow, University of Michigan.

Nematocysts, isolated by digestion and maceration, can be discharged by raising their internal pressure.

The pressure needed to bring about explosion varies with conditions. It may be artificially altered by immersion in various liquids, a fact which explains why the nematocysts of eolids explode in sea water, whereas those freshly isolated from cœlenterates, do not.

When stimulated, the nematocyte is a factor in the discharge of the thread. It is not possible to show that stimulation of the mother-cell results from all the conditions under which explosion occurs. Nevertheless, it is probably true that when a nematocyst discharges as the result of conditions normal to the lives of cœlenterates, it

does so because the nematocyte enclosing it has been stimulated.

Elevation of the internal pressure of the nematocyst may be the cause of normal explosion in cœlenterates. If we suppose that stimulation of the nematocyte inaugurates changes which result in lowering the concentration of the cell contents surrounding the nematocysts, the result can be understood. If, as is not unlikely, heat is liberated, the matter becomes still easier, for either dilution or heat can separately bring about the instantaneous discharge of freshly isolated nematocysts.

Distortion brings about the discharge of isolated nematocysts, but uniform external pressure is useless. It might be supposed that inside the nematocyte there is a mechanism capable of squeezing the nematocyst. Such a mechanism is at present purely hypothetical, and, it seems to me, not needed to explain the facts.

The threads of nematocysts, contrary assertions notwithstanding, are able to penetrate the tissues of other animals, but in order to do so must make their punctures during the period of highest speed, viz., at the beginning of the eversion. This observation renders unnecessary the assumption of a "Reizgift," made in order to account for the nettling sensation produced by nematocysts.

The Behavior of the Cuckoo: FRANCIS H. HERRICK, Western Reserve University.

There is no conclusive evidence to show that the American black and yellow-billed cuckoos are either losing their nesting instincts, or that once having lost them they have been regained. Possibly a lack of attunement of the cyclical instincts occasionally seen in all birds, and rather more frequent in these cuckoos, may have been the starting point of the "parasitic" habit of *Cuculus canorus* and related old-world genera. Parental instinct is strong in the American cuckoos, and their nests, though frail, are well adapted to their purposes.

The eggs are commonly laid and hatched on alternate days, but nest-life is not unduly prolonged in consequence, this apparent extension being counterbalanced by the development of a remarkable climbing instinct in the young and a premature desertion of the nest. In the life and behavior of the young cuckoo three stages are clearly distinguished: (1) period of infancy, when their black skin is sprinkled with snow-white "hairs" or rudimentary down; (2) complete quill stage on the sixth day and (3) the climbing stage when on the seventh day the nest is summarily deserted by each bird in order of development, and marked by a sudden though incomplete transition to the feather state.

The cuckoo is remarkably enduring from birth, and its grasping reflex most striking. When born it can support its own weight with one foot or with a single toe. Later with feet and bill it easily raises itself upon any support. At the close of the quill-stage fear is present, and there is perfect association with the nest and parent. The feather tubes now begin to give way at their base, especially over the breast and abdomen, and in the energetic practise of the preening instinct the tubes are combed off by the mouthful and in a few hours. The tubes of the flight-feathers and those of the back break away centripetally, so as to expose the shafts gradually as in other birds. When the bird climbs out of the nest early on the seventh day it is only half fledged, quills still showing on head, neck and back. In the climbing stage, when they remain in bushes for upwards of ten days, their behavior suggests that of the young hoatzin.

In serving the large caterpillars and larvæ which are brought to the nest by both parents, the insect is placed in the *mouth*, and not in the throat, as in nearly all birds observed, and is held there for, it may be, five minutes, neither bird moving, or until the swallowing reflex is started. The last bird in the nest is apt to be deserted, parental instinct being diverted and satisfied by the attentions which those already in the bush demand.

Phototaxis in Fiddler Crabs: S. J. HOLMES, University of Wisconsin.

The Reactions of Amphibians to Light: A. S. PEARSE, University of Michigan.

Ten representative species of amphibians were tested and all of them showed marked phototropic reactions. In most instances these species gave the usual responses after the eyes had been removed, the skin serving as a photoreceptor. When a toad was stimulated through only one eye by light from in front or when the skin of an eyeless toad was subjected to unilateral stimulation by light from above, the resulting locomotion was toward the stimulated side and not toward the source of illumination. Such responses are, therefore, brought about by bilateral differences in stimulation and not by any orienting influence due to the direction of the light rays. Previous conditions of light stimulation had no apparent effect on the photic responses of the toad.

Although the rays toward the violet end of the

spectrum produced the largest number of positive responses from normal salientians, no such potency was manifested by the shorter rays when eyeless individuals were tested. In the latter case all rays were equally effective in inducing reactions.

Eyeless toads which gave marked phototropic responses were indifferent to radiant heat of an energy value equivalent to that of the light used. It may, therefore, be affirmed that thermo- and photo-reception are distinct processes in the toad's skin.

Spinal amphibians gave no photic responses, but light reactions were induced in animals which had lost the portions of the brain anterior to the metencephalon.

The Receptiveness of the Vertebrate Skin for Light and the Origin of the Vertebrate Eye: G. H. Parker, Harvard University.

In the last few years it has been shown that numerous amphibians will respond to light by moving either toward it or away from it even after their eyes have been removed. The receptive organ in this response is the skin. Tests of a like kind have been made on only a very few fishes. It is highly probable that the skin of *Amphioxus* and of *Fundulus* is not sensitive to light and it is very certain that that of ammocœtes is highly sensitive to this stimulus. To ascertain the condition in other fishes, blind individuals of nine species of marine forms were tested by throwing upon the side of the body a beam of concentrated sunlight. The species tested were *Mustelus canis, Anguilla chrysypa, Fundulus heteroclitus, Stenotomus chrysops, Tautogolabrus adspersus, Tautoga onitis, Chilomycterus schœpfi, Opsanus tau* and *Microgadus tomcod.* In no instance was any reaction observed. As all these species and *Amphioxus* are marine and the amphibians and ammocœtes are inhabitants of fresh water, it seems as though fresh water was favorable for the development of integumentary sensitiveness to light and salt water inimical to this. The condition may be just the reverse of animal phosphorescence which is common in the sea, but unknown in fresh water. If further investigation should prove that no marine vertebrate has an integument sensitive to light, such theories of the origin of the vertebrate eyes as derive it from the skin would be rendered highly improbable.

Methods of Studying Color Vision in Animals: Robert M. Yerkes, Harvard University.

There are three general methods of obtaining chromatic stimuli: the reflection method (absorption and reflection by colored papers, cloths, pigments), the transmission method (absorption and transmission by colored glasses, gelatines, solutions) and the refraction method (dispersion spectra by means of prism).

Of these three methods, the first is purely qualitative, and has as its chief recommendation the naturalness of its stimuli. The second method is both qualitative and quantitative, but it fails to give the experimenter that degree of control of the wave-length of his stimulus which is demanded by the thoroughgoing and rigidly scientific quantitative investigation. The third method promises to meet the chief requirements of quantitative work.

These requirements are that the method shall enable the experimenter (1) to obtain stimuli of any desired wave-length or range of wave-lengths, (2) to measure the wave-length of the stimuli accurately and with reasonable facility (preferably by means of a calibrated slit mechanism), (3) to control the intensity of the stimuli perfectly by (*a*) moving the source of light, or (*b*) changing the size of the beam, or (*c*) interrupting the beam, or by each of these methods in turn, (4) to measure the intensity of stimuli accurately and easily both photometrically and radiometrically (preferably by means of a calibrated mechanism), (5) to present chromatic stimuli to his subject independent of the secondary criteria of discrimination: size, form, distance, position, texture of surface and temperature.

Investigations now in progress in the psychological laboratories of Harvard and Johns Hopkins universities, under the direction of the committee on standardization of tests appointed by the American Psychological Association, promise to provide us soon with an admirable method for the study of color vision in animals. A report of the results of these investigations is now in course of preparation by R. M. Yerkes, J. B. Watson and E. D. Congdon.

An Account of Experiments for Determining the Complete Life History of Gasterostomum gracilescens: D. H. Tennent, Bryn Mawr College.

In previous work[1] the writer demonstrated the life history of *Gasterostomum gracilescens* with the exception of infection of the oyster.

During the summer of 1908 I obtained *Lepisosteus osseus* from the region of oyster beds in Newport River, North Carolina, and found that they contained *Gasterostomum* in abundance. The fæces of the fish were found to contain *Gasterostomum* embryos.

[1] *Quart. Jour. Mic. Sci.*, Vol. 49, pp. 635–690.

A mixture of fæces in water was injected between the valves of uninfected oysters and these oysters were placed in a wire box in the water. After one month these were taken up and examined. Of twenty-six oysters thus treated twenty-two were alive and contained sporocysts of *Gasterostomum* immediately outside of the stomach wall.

This experiment completes the demonstration of the life history as follows:

1. Adult *Gasterostomum* in *Lepisosteus osseus* and in *Belone vulgaris*.

2. Sporocysts and cercariæ (*Bucephalus*) in the oyster.

3. Free immature and encysted *Gasterostomum* in *Menidia* and other small fishes which serve as food for *Lepisosteus* and *Belone*.

The work also indicates the probable identity of *Bucephalus polymorphus*, found in fresh-water mussels, and *Bucephalus haimeanus*, found in various marine lamellibranchs.

Embryonic Variability in Echinoids: D. H. TENNENT, Bryn Mawr College.

Study of variations of plutei of same age, but from eggs of different females.

Comparison of fed with unfed plutei.

Study of plutei obtained from eggs of one female which were divided into several portions and each portion fertilized with sperm from a different male.

Variation in the Tentacles of Hydra viridis: ALBERT M. REESE, West Virginia University.

These investigations sought to show (1) the variation in the number of tentacles, (2) the relation between the original number of tentacles and the number regenerated after decapitation and (3) the relation between the number of tentacles of a bud and the number possessed by the parent.

Parke states that the number of tentacles varies from four to eleven; and Rand says that in one hundred and fifty *Hydras* only three had nine tentacles, while about 12 per cent. had eight tentacles.

In the six hundred *Hydras* here studied the tentacles varied in number from four to twelve. Only four individuals with the greater number of tentacles were found. About 54 per cent. of the *Hydras* had eight tentacles, 24 per cent. had seven tentacles, and 15 per cent. had nine tentacles. The other numbers between four and twelve were represented by small percentages.

Even in different parts of the same twenty-foot aquarium the average number of tentacles varied, although the conditions were, apparently, exactly the same.

As has been noted before, the number of tentacles generally increases with the size and the age of the *Hydra*, though, under unfavorable conditions, the number may decrease with age.

As has been stated by former workers, the number of tentacles regenerated by a decapitated individual is nearly always less than the original number possessed by the *Hydra*. The average number of regenerated tentacles for seven-tentacled *Hydras* was 5.73, for eight-tentacled *Hydras* it was 6.47.

Parke states that the number of tentacles on buds varies from four to six, and is always less than the number possessed by the parent. In the *Hydras* here studied the buds had from six to nine tentacles, and in only 50 per cent. of these cases were there less tentacles upon the bud than upon the parent. In 37.5 per cent. of the budding *Hydras* examined the number of tentacles of bud and parent was the same, and in the remaining 12.5 per cent. of cases the bud had actually more tentacles than the parent.

A Report on the First Forty-three Generations of an Experiment concerning the Effects of Disuse: F. E. LUTZ.

The fly, *Drosophila ampelophila*, was bred for more than forty-three generations under conditions which prevented the use of the wings. There was no indication of any degeneration either in the absolute or relative size of the wing or in the venation.

Darwin's Case of Reversion in Poultry: C. B. DAVENPORT, Cold Spring Harbor, N. Y.

The cross between a black Spanish cock and white Silkie hen (an albino) produces black chicks, of which the cocks gain some red in the plumage of those feathers that are red in the jungle fowl. Darwin called this reversion. The second hybrid generation reveals the full story. Typically game-colored males and females appear in this generation. The whole matter is explained on the theory that the Spanish contains the factors: color factor, C; jungle fowl color pattern, J; and extra black coat, N; whereas C and N are absent in the Silkie. In the second hybrid generation theory calls for nine blacks to four whites and three games and this proportion is actually obtained.

A Substitute for the Theory of Warning Coloration: JACOB REIGHARD, University of Michigan.

Many of the coral-reef fishes of the Tortugas region are very conspicuous in their natural en-

vironment, as shown by photographs taken by a submerged camera.

The conspicuousness is of the sort typical of warningly colored insects and is often associated with formidable means of defense.

The conspicuousness is not due to secondary sexual coloration.

These fishes do not show aggressive resemblance and such resemblance is unnecessary for them, since their food consists chiefly of fixed invertebrates.

They do not show protective resemblance and have no need of it, since the coral-reef habitat affords them ample protection from their enemies.

Their conspicuousness is not an instance of warning coloration, since they are readily eaten by the commonest piscivorous fish of the region (*Lutianus griseus*), when removed from the reefs, although this fish possesses color vision, forms associations readily and retains these associations for a considerable time, and has therefore the qualities which would enable it to take advantage of warning coloration in its food.

The conspicuousness of the coral-reef fishes has therefore not arisen through selection of any sort, but is an expression of the action of internal forces (race tendency), in the absence of counteracting selection.

The disagreeable qualities of warningly colored insects is universally held to have been present before these insects became conspicuous. They therefore served at the start to inhibit the attacks of vertebrate foes and thus rendered protective coloration unnecessary for such insects.

The nature of their food has rendered aggressive coloration unnecessary to warningly colored insects.

The conspicuous colors of warningly colored insects have therefore arisen in the absence of selection, under immunity from selection. They are to be attributed to the action of internal forces unchecked by selection.

Other conditions than inedibility may so limit the attacks of vertebrate foes on insects (and other animals) as to render them free from selection from this source and wherever, in such cases, the nature of the food renders aggressive coloration unnecessary the insects are immune from the action of selection and free to develop conspicuousness. Inaccessibility may thus condition conspicuousness, and probably does so in the case of many edible butterflies.

The theory of immunity coloration is proposed as a substitute for the theory of warning coloration, while at the same time it covers certain cases not covered by the theory of warning coloration. Immunity coloration is defined as follows: "Coloration, not sexually dimorphic, which renders an organism in its natural environment conspicuous to vertebrates; which has no selective value, since it does not aid the organism in escaping vertebrate enemies by concealment (protective coloration), nor in approaching its accustomed invertebrate prey (aggressive coloration), and when associated with disagreeable qualities is unnecessary as a warning to vertebrate foes of the existence of such qualities (warning coloration); it is conceived to have arisen through internal forces under immunity of the organism from selection acting on its color characters." The exclusion of sexually dimorphic characters from the definition is provisional.

The Partulæ of the Society Islands, and the Problems of Distribution and Isolation: H. E. Crampton, Columbia University.

The survey of the islands of the Society Group of Polynesia was completed during the years 1907 and 1908, and the results have made it possible to offer relatively final statements regarding the variation and distribution of the species of *Partula* that occur in the group. Each island possesses characteristic forms, that with two exceptions are absent from other islands. The two peaks of Tahiti contain nearly similar forms; the two separated halves of Huaheine have the same species, although these exhibit more differences than the species of Greater and Lesser Tahiti; Tahaa and Raiatea are wider apart, although they have the same encircling reef, and their species are far more differentiated; finally, Borabora and Moorea possess unique forms, in correspondence with their total isolation from other islands.

A comparison of the valley faunas in any and all islands reveals a similar relation between geographical separation and racial divergence, and all the islands agree in demonstrating this correspondence. Evidence was presented showing that environmental influences can not be regarded as the immediate factors for racial differentiation, and that mutation has played a large if not an exclusive part in the process. The rôle of natural selection is restricted to a purely negative part.

The Experimental Modification and Control of the Behavior of Characters in Crossing: W. L. Tower, University of Chicago.

A Theory of the Modification and Origin of Characters in Animals: W. L. Tower, University of Chicago.

Color Inheritance in Crosses Between the Black Rat (Mus rattus) and the Roof Rat (Mus alexandrinus): T. H. MORGAN, Columbia University. (See *American Naturalist*, 1909.)

Some Methods and Results of Pigeon Breeding at the Rhode Island Experiment Station: L. J. COLE, Yale University.

Preliminary Statistics on the Nidification and the Proportions of the Sexes in Pigeons: L. J. COLE, Yale University.

The Inheritance of Egg-producing Ability (Fecundity) in the Domestic Fowl: RAYMOND PEARL and FRANK M. SURFACE, Maine Agricultural Experiment Station.

The data discussed in this paper were obtained from two lines of work. The first of these was an experiment in which for a period of nine years hens have been selected for high egg production. No hens were used as breeders whose production in the pullet year had not been 150 or more eggs. The cockerels used were, after the first year of the experiment, invariably the sons of mothers producing 200 or more eggs in their pullet year.

The second source of data was an experiment in which the inheritance of egg production from mother to daughter was directly measured. Records of the pullet year egg production of 250 daughters of hens laying 200 or more eggs in *their* (the mothers') pullet year were obtained.

Certain of the most important results obtained may be summarily stated as follows:

1. Selection for high egg production carried on for nine consecutive years did not lead to any increase in the average production of the flocks.

2. There was no decrease in variability in egg production as a result of this selection.

3. The present data give no evidence that there is a sensible correlation between mother and daughter in respect to egg production, or that egg-producing ability (fecundity) is sensibly inherited.

4. In this experiment the daughters of "200-egg" hens did not exhibit, when kept under the same environmental conditions, such a high average egg production as did pullets of the same age which were the daughters of birds whose production was less than 200 eggs per year.

5. The daughters of "200-egg" hens were not less variable in respect to egg production than were similar birds whose mothers were not so closely selected.

Color Changes of Ocypoda arenaria: R. P. COWLES, Johns Hopkins University.

Under certain conditions a dark color pattern can be distinctly seen through the carapace of *Ocypoda arenaria;* under other conditions this pattern disappears.

Many experiments were performed to test the effect of intensity of light, degree of temperature, mechanical and chemical stimuli. It was found that the first two factors determined the appearance and the disappearance of the color pattern.

In direct and diffuse sunlight when the temperature is kept low the pattern is visible, but when the temperature is high the pattern disappears.

In the absence of light at low medium and high temperature the pattern fails to appear.

Of the two factors, intensity of light and degree of temperature, the former is the more important.

A Gynandromorphous Crayfish: E. A. ANDREWS, Johns Hopkins University.

A specimen of *Cambarus affinis* proves upon study to be an immature male with a few external sex organs that should appear only upon the female.

This gynandromorph, or individual with a mixture of organs normally found upon two individuals, male and female, has a normal testis with no sign of ovogenesis, and two normal, but little developed deferent ducts and the two normal male papillæ at the bases of the fifth thoracic legs. Moreover, the limbs of the first and the second abdominal somites are as in a normal young male and the hooks of the third thoracic legs are normal.

On the other hand, the third thoracic legs bear two elliptical openings that closely imitate the openings of oviducts. These openings are mere blind cuticular structures and do not communicate with any internal organs.

Most of the gynandromorph crayfishes hitherto known have been females with some male traits.

This case emphasizes the independence of gonad and external sex organ, and is in opposition to internal secretions as a cause of appearance of external sex organs.

Whether such mixtures of sex organs can be due to abnormal fertilizations, to polyspermy, may be decided by future experiments in cross breeding of crayfish. At present the evidence seems to indicate that these gynandromorphs may arise in the ovarian egg.

Organs of Sperm-transfer in Male Crayfish: E. A. ANDREWS, Johns Hopkins University.

Though the sperms of crayfishes appear to be killed by fresh water yet they are transferred by the male to the outside of the female while under water. A comparative study of the reflexes and instincts involved shows the use of three sets of organs in the male that are necessary for the perpetuation of the species. These are the papillæ of the last thoracic limbs and the specialization of the first and the second limbs of the abdomen. In *Cambarus* there are also one or two pairs of hooks upon the thoracic legs.

The anatomy of these structures shows that in *Cambarus* the first abdominal appendage is much more complex and accurately adjusted than had been thought, so that these crayfish are even more highly evolved than they had been considered to be. On the other hand, the like appendage of the crayfish of Japan is not fundamentally as much like that of *Cambarus* as had been thought, but more primitive. This tends to lessen the difficulties of one problem of geographical distribution of crayfish by lessening the resemblance of eastern Asiatic to eastern American forms.

The evolution of the accurately interadjusted male and female organs of sperm-transfer in crayfishes seems to admit of no present scientific explanation.

Pelagic Nemerteans: W. R. Coe, Yale University.

Comparative anatomical studies of numerous species from various parts of the world leave little doubt as to the affinities of these aberrant forms. Recent discoveries of pelagic species show that they are distributed around the whole circumference of the globe, and although they do not appear to be abundant in any locality, the Arctic and Antarctic oceans are the only large bodies of water without known representatives. The structure of the proboscis, the arrangement of the muscular layers of the body, and the disposition of the blood vessels, indicate their origin from more than a single one of the more generalized types of Hoplonemerteans.

The Breeding Habits of the Squid: Gilman A. Drew, University of Maine.

It has long been known that female squid with nearly mature eggs have packages of sperm attached to their outer buccal membrane. This summer Professor E. G. Conklin observed a few packages of sperm on the oviduct of a squid. Observations following this have shown that this is not an uncommon, but, on the other hand, not a universal condition.

The transfer of the sperm to both of these locations has been observed many times during the past summer.

When the sperm is deposited on the oviduct, the male grasps the female around the body just behind the mantle opening, or frequently attaches further back and crawls forward. The dorsal side of the male is usually just below or a little to the left of the ventral side of the female. The male then extends its penis well into its funnel, ejects a bunch of spermatophores, which it catches at the outer opening of the funnel with the end of its left ventral arm. This arm, with the spermatophores, is immediately inserted far into the mantle chamber of the female by the left side of her neck above the funnel, and held there perhaps ten seconds. Its position can sometimes be seen through the transparent mantle of the female. It is then withdrawn, the male releases the female, and a few seconds later the empty cases of the spermatophores escape from the female with the water leaving her funnel. Examination of such a female reveals fresh sperm sacs attached to the oviduct.

The transfer of sperm to the buccal membrane is accomplished while the animals are attached head to head.

The discharge of the spermatophores is similar to *Rossia* as described by Racovitza.

Several females were observed while depositing their eggs. Usually the female rests quietly upon the bottom for several minutes before a string of eggs is to be deposited. In this position she frequently remains until the end of the string protrudes about three quarters of an inch from the funnel. She then begins to swim backward, largely by means of the fin, but partly by water that escapes from the funnel around the egg string. While swimming in this manner, she passes her two dorsal arms between the others and catches the end of the egg string with them and draws it up between the arms as it leaves the funnel. Here it remains for two or three minutes, entirely surrounded by the arms, which are kept nervously moving against each other, while she slowly swims about. Just before sticking the egg string to the bottom, she becomes exceedingly nervous in her actions and frequently goes dancing over the bottom on the tips of her arms with the body perpendicular, in a most sensational manner. Suddenly, while the body is perpendicular, or nearly so, she attaches to the bottom with the ends of her arms, draws down tight against the bottom and then withdraws, leaving the egg string attached.

Molluscan Studies on Lake Champlain: H. F. PERKINS, University of Vermont.

Some Holothurian Structures: CHARLES LINCOLN EDWARDS, Trinity College.

In *Cucumaria frondosa* I have found vestigial anal teeth, well marked in specimens 1–2 mm. long, one developing at the posterior termination of each mid radial line just beyond the bases of the last pair of pedicels and *outside* of the anus. These anal teeth remain small and can be found in a majority of the adult specimens, but are never functional and hence may be regarded as vestigial. In very young *Holothuria floridana* I have found three fan-shaped calcareous plates, two lateral and one posterior, which function somewhat as anal teeth, disappearing in the adult, and they also are vestigial structures.

In *Cucumaria frondosa*, the female has a simple, conical genital papilla, while in the male it is subdivided into three to ten parts. The distal portion of each part bifurcates, a genital pore terminating each branch, while the proximal portions of all parts fuse in the common base. Heretofore subdivided, or multiple, genital papillæ have been known only in a few Elasipoda, but I have seen no record of differentiation in the form of male and female genital papillæ. In one *Thyone* and two *Cucumaria* a genital papilla in the male only has been reported.

The Growth of Parts in the Dogfish: WM. E. KELLICOTT, Woman's College of Baltimore.

The weights of the brain, heart, rectal gland, pancreas, spleen, liver and gonads were determined in a series of 315 dogfish (*Mustelus canis*), including specimens from birth, weighing about 76 grams, up to a maximum observed weight of 8,434 grams.

It was found that these organs did not grow at the same rates nor at the rate of the organism as a whole. These parts, except the gonads, are heaviest, relative to the total weight, at birth or soon thereafter and from this time onward constantly diminish in relative weight.

Since the parts of the organism do not grow similarly, description of its growth by recording total weights does not describe the actual growth processes of the whole organism, but chiefly of some predominating parts—in most vertebrates these are the muscles and connective tissues which make up roughly 75 per cent. of the total weight.

In this indeterminately growing form all the parts mentioned tend to be outgrown by the muscles and supporting tissues; a condition of determinate growth might be derived from this by the action of some mechanism for stopping the growth of these tissues at such a point that the brain and viscera remain competent as physiological elements.

The Criteria of Homology in the Peripheral Nervous System: C. JUDSON HERRICK, University of Chicago.

The synonymy of the peripheral nerves of lower vertebrates is in great confusion. This is largely due to the fact that the exact composition of the various rami (particularly of the cerebral nerves) was formerly imperfectly known, and hence nerves of very diverse composition were often compared on the strength merely of topographic similarities of distribution. With the extension of our knowledge of the nerve components of representative vertebrates, it becomes desirable that a standard method of procedure be established in the determination of homologies and in the selection of names for mixed rami and in other cases in which diversity of usage has arisen. A few rules governing homologies are suggested in the present paper, which will be published in the *Journal of Comparative Neurology and Psychology.*

On a New Species of Goblin Shark (Scapanorhynchus jordani) from Japan: L. HUSSAKOF, American Museum of Natural History.

Scapanorhynchus (*Mitsukurina*) is a rare shark occasionally taken in the deeper waters of Japan. Only one species has hitherto been known, *S. owstoni* Jordan. In the present paper a second species was described, for which the name *S. jordani* was proposed. It differs from *owstoni* in the much lesser protrusibility of the jaw, much smaller spiracle, smaller gill area and the more forward position of the nostril, eye and spiracle.

The proper generic name of this shark was discussed. The fish was originally described by Jordan under the name *Mitsukurina;* but this genus, as has been pointed out by several investigators, is apparently identical with the Cretaceous form *Scapanorhynchus.* The latter name has priority.

Some Features of the Development of Desmognathus fusca: W. A. HILTON, Cornell University.

Tactile Reactions and Polarity in Tentacles of Actinians: H. W. RAND, Harvard University.

The following demonstrations were exhibited:

Specimens of the Partulæ of the Society Islands, Illustrating Distribution and Isolation: H. E. CRAMPTON.

Races of Paramecium and their Relation to Selection and Conjugation: H. S. JENNINGS.

Demonstrations to Illustrate the Modification and Control of Behavior of Characters in Crossing: W. L. Tower.

Photographs Illustrating the Regenerative Power of the Somatic Cells of Sponges after Removal from the Parent: H. V. Wilson.

Specimens of the 900th Generation of Paramecium, Attained without Artificial Stimulation or Conjugation: L. L. Woodruff.

Lorande Loss Woodruff,
Secretary

Yale University

SOCIETIES AND ACADEMIES

THE BIOLOGICAL SOCIETY OF WASHINGTON

The 453d meeting was held January 23, 1909, with President Palmer in the chair. Several informal notes were presented. Mr. F. E. Matthes offered some notes on snow and winter insects collected in the vicinity of Washington. Among the true snow insects especial interest attaches to *Boreus nivalis* (Neuroptera). This insect is common in the northern states, but has hitherto been considered rare in the District of Columbia. On Christmas day, 1908, and at various times in January, 1909, it was found in abundance in Rock Creek Park. On the date first mentioned, two of this species were observed mating on the snow. On the same day large numbers of winter insects belonging to the Hymenoptera were gathered in the same locality. They represent the winter generation of two Cynipid gall flies, consisting of hermaphroditic individuals, whose larval stages are passed in the roots of oak trees. They oviposit in the young buds of the same tree, thus producing the galls on the leaves in which the summer generation develops. It appears essential, according to observations by Dr. E. A. Schwarz and others, that the ovipositing be done as soon as the buds show the first signs of life in spring. It takes place therefore about the end of February as a rule. In view of this, it seems surprising that the insects should have been found at so early a date as December 25, almost two months prior to the first budding of the leaves.

The difficulties attached to any studies whereby the winter generations of these species might be connected with the corresponding summer generations have thus far proved almost insuperable, and as a consequence no definite correlation exists as yet. For the present the individuals of the winter generation (which look quite unlike the summer generation) are referred to the genus *Andricus*. Both *Andricus* species found have atrophied wings, those of the larger species being apparently perfect but about half the size necessary for flight. They thus possess a characteristic also found in *Boreus*. In the male of the latter, however, the wing remnants are of an imperfect and strangely aberrant type.

Mr. M. B. Waite exhibited a Jonathan apple having a peculiar decay. The specimen represented a lot which had been shipped from Colorado to Los Angeles, California, kept there in cold-storage, and then sent to Washington for diagnosis. Three species of apple rot fungi found in the decayed spots were considered secondary since most of the decayed areas were free from fungi or bacteria. The discolored areas, often in the form of a band around the apple, were firm in texture, light brown in color, and extended to a moderate depth in the flesh of the apple. The cells in the discolored areas were collapsed and ruptured, thus coinciding with frost injury. The damaged area was concluded to be due to freezing, or, since the apple stands freezing, to the peculiar conditions of thawing out after freezing.

Dr. H. M. Smith announced and commented upon the transfer of the administration and personnel of the federal fur-seal service to the Bureau of Fisheries.

Dr. B. W. Evermann reported an observation made by his brother, A. M. Evermann, near Burlington, Indiana, showing that fox squirrels sometimes feed upon the seeds of the cocklebur (*Xanthium strumarium*). The observation was made January 19 when snow covered the ground. The squirrels carried the burr to a log at the edge of a field and there got at the kernels by gnawing away one side.

He also reported the capture of a barn owl in Carroll County, Indiana, in December, 1908. This species had not been previously recorded from that county.

The regular program consisted of the following four papers:

Bee Diseases: E. F. Phillips.

The honey bee, *Apis mellifera*, is subject to several specific diseases which are well recognized among practical bee keepers. The causes of all of them are not fully understood. Two of these attack the bee in its embryonic stages and are now designated American foul brood and European foul brood. They attack the bee just about the time that pupation begins and the colony is depleted because as the adult bees die from natural causes there are not enough bees emerging