ment, the National Conference of Commissioners on Uniform Legislation, to which reference has been made, has become a standing institution of unquestioned authority. That authority, indeed, is only to deliberate and to recommend. It makes no agreements between states. But it does initiate action by the states, through which, on some points, they are brought by the legislative action of each into a position of agreement.

Should it be able to agree on the recommendation of a definite, equal and consistent policy as to the subject which has been under our consideration, expressed in the form of an identical statute for general adoption in each of the states which it represents, it is not impossible that, one after another, the states would fall into line and follow the plan proposed.*

The tendencies of the time make for such a movement. Individualism and state-isolation are each giving way at every point of material contact to collectivism. The time-spirit and the world-politics of the twentieth century alike point to reciprocal governmental action on a great scale, for the prevention of international or interstate complications and collisions, as the true basis of national prosperity.

SIMEON E. BALDWIN.

* One state has already made a move in this direction. Connecticut prior to 1903 had not taxed goods of non-resident decedents by means of a succession duty. In 1903 she laid such a tax on them, but with a waiver of its enforcement in case of a succession to decedents belonging to a state or country not exacting such a duty upon personal property left within its jurisdiction by Connecticut decedents. Public Acts of Conn. for 1903, 43, Sec. 2. Gallup's Appeal, 76 Conn. Reports, 627; 57 Atlantic Reporter, 699.

PROCEEDINGS OF THE AMERICAN SOCIETY OF ZOOLOGISTS. SECOND ANNUAL MEETING OF THE EASTERN BRANCH.

THE second annual meeting of the Eastern Branch of the American Society of Zoologists and the fifteenth annual meeting of the society since its establishment as the American Morphological Society, was held in the laboratory of physiology and pathology, University of Pennsylvania, Philadelphia, Pa., on December 27, 28 and 29, 1904.

The committee on the invitation to the International Zoological Congress to meet in this country reported that a formal invitation signed by all the members of the joint committee was personally presented at the recent meeting of the congress in Berne by Dr. Charles S. Minot and Dr. Ch. Wardell Stiles, members of the committee. The congress voted unanimously to accept the invitation and to hold its next meeting in Boston during the month of August, 1907. The congress further elected Mr. Alexander Agassiz president of the congress for the Boston meeting, and agreed to intrust the general arrangements for the meeting to the representatives of the American Society of Zoologists. It was voted that the appointment of a committee to make the necessary arrangements be left with the executive committee of the Eastern Branch acting with the executive committee of the Central Branch of the society.

The committee on zoological requirements for admission to college presented its report, which was approved. This report was published in SCIENCE, N. S., Vol. XX., December 16, 1904, pages 850–853.

It was voted that the matter of the publication of proceedings and abstracts be referred to a committee composed of the retiring secretary and the newly elected president and secretary. The officers elected for the ensuing year and those with unexpired terms are as follows:

President—William E. Castle.

Vice-President—William Patten.

Secretary and Treasurer—Henry S. Pratt.

Additional Members of the Executive Committee—Hermon C. Bumpus, Herbert S. Jennings and Ethan A. Andrews.

The following are abstracts of papers presented at the meeting:

Correlation and Variation in the Honey Bee: Everett F. Phillips, University of Pennsylvania.

This work is a continuation of the work done by the writer with Dr. D. B. Casteel.* The usual statistical methods have been used and the material used was uniformly Italian stock, each lot numbering 500. Workers, drones from drone cells and drones from worker cells were examined and characters of the wings were measured, the veins m and m_2 and the hooks on the hind wing. In every character examined the drones showed the greater variability, although they come from parthenogenetic eggs, while the workers come from fertilized eggs. The abnormalities of venation are also more numerous in drones.

In preparation for this work two queens (sisters) were introduced to colonies of bees, one of which had no drone comb, while the other had. In both cases drones were produced in abundance. In the hive having only worker cells the drones showed a reduction of 9.13 per cent. in the mean of the character compared, showing that the size of the bee is influenced very greatly by the cell in which it grows. Since just such cases appear in nature, the variation is influenced greatly by environment. The same difference in the size of the cell occurs in the development of female eggs into workers or queens, but here a difference in the food also enters into the consideration.

Several correlations were computed and there is a high degree of symmetry of the two sides of the body but a very low correlation between fore and hind wings. The veins m and m_2 which join each other show no correlation.

The full tables and computed results of this work will be published elsewhere in the near future.

Correlation in Development: O. C. Glaser, Johns Hopkins University.

In the development of *Fasciolaria* a process of cannibalism takes place during which six or eight embryos swallow their less fortunate comrades, and all the unfertilized eggs in each capsule. A fully gorged cannibal may contain over 300 eggs. Correlated with this habit, which taxes to the utmost the assimilative and excretory powers, are the external kidneys. In addition to their activity as renal organs, they present two other correlations with cannibalism. In *Fulgur* they originate simultaneously with and behind the velum; in *Crepidula* they originate after the velum and behind it; but in *Fasciolaria,* probably because of the need for them, they originate before the velum appears. This earlier origin conditions a change in ultimate position, for being just below the place where the velum originates, this on growing latterly carries the excretory organs with it. Finally they hang down from its under surface. Thus cannibalism has affected the origin of these organs and the structure of the veliger.

Accessory excretory organs, and amitosis in the endoderm of the veliger are also correlated with cannibalism.

Why are so many eggs infertile? This seems to be due to ovogenetic processes. These may possibly be analogous to those occurring in the spermatogenesis of *Paludina,* for as *Fasciolaria* has 'oligopyrene' and 'eupyrene' spermatocytes which yield corresponding spermatozoa, it may also have 'oligopyrene' and 'eupyrene' ovocytes which would mature into corresponding eggs. If this prove true a far-reaching correlation exists between maturation and the whole life history.

* 'Comparative Variability of Drones and Workers of the Honey Bee,' *Biol. Bull.,* December, 1903, pp. 18–37.

Whether this particular correlation exist or not, *Fasciolaria* illustrates how remote processes may affect the life of an organism, and how habits, apparently so useless as the manufacture of infertile eggs and imperfect spermatozoa, may be perpetuated, since such habits may have indirect results which, like cannibalism, are useful to the species.

The 'Great Forceps' of the Lobster: FRANCIS H. HERRICK, Western Reserve University.

In the higher orders of crustacea the chief weapons of both attack and defense, as well as for rending the prey, are the pincers or 'forceps,' borne on the first pair of massive periopods. In both American and European species two types of claw are developed, irrespective of sex, on either the right or left sides, the more primitive *toothed* or *lock-forceps,* and the larger, secondarily modified *crushing claw.*

In a fuller paper I shall be able to offer for the first time a complete history of the curious periodic sequence (first noticed by Starr in 1898), which occurs in the spines of the toothed claw, and which is apparently unique among animals—as well as of the development of the two types of claw, their structure, physiology and the changes which ensue in molting.

In the more slender lock-forceps the teeth are arranged in a linear series, in periods of eight. About midway in the serrated margin of the 'hand' or larger joint is a stout displaced spine of the first order, which forms the 'lock' to the claw. Upon closing, the dactyle falls on this spur, and its teeth slide under those of the propodus. It is thus firmly locked in this position, so that no lateral motion is possible. To meet this adjustment the tips of the claw are bent so that the dactyle is overlapped; the spines of the two joints are further inclined in opposite directions and aligned in a reversed manner.

When perfect, the formula for each period is as follows: 1:4:3:4:2:4:3:4:=8. About four periods occur between the tip of the claw and the lock spine. The primary spines (1) are the first to arise, and are consequently the oldest, as they are the largest in the series. The primary spines alone are developed as the first larval stage, and tend to increase in geometrical ratio, by the regular interpolation of new spines between those already formed, in a linear series. There is even a tendency to advance to the fourth progression, which if effected would give periods of sixteen. Spines of the second and third order begin to appear in the third larva, while in the fourth stage usually at least one eight-period series is developed.

During the larval stages tegumental glands open by capillary ducts on the proximal side of each spine, near its tip. The tips of the claws develop like setæ or 'hairs.'

At the fourth stage both large claws are similar and of the toothed type. Differentiation of the crushing claw begins at about the eighth molt, the large tubucles being formed by a fusion of periodic teeth.

The chelæ abound in tufts of tactile hairs, especially in early life, but show no other peculiar sense-organs. The 'fine meat' of the tips of the claws is a sponge-work of involuntary muscle-fibers, to which blood has access, and is adapted to meet the needs of the molting period, when great local changes in blood-pressure are demanded.

The periodic sequence of the teeth in the toothed type of claw may be regarded as of incidental significance only, in increasing the efficiency of a nicely adapted prehensile tool and weapon. Cases of symmetry which occasionally occur may represent a reversion to the primitive and larval type, in an incomplete stage in the reversal of asymmetry, and therefore concerned with

regeneration, like the phenomena observed by Przibram in *Alpheus*.

Torsion in the Crustacean Limb: Francis H. Herrick, Western Reserve University.

In crayfishes and lobsters the dactyles of the great claws face, and, therefore, open inward and in a nearly horizontal plane, while the smaller chelæ open upward and outward in a plane which is nearly vertical. In the lobster at birth, however, the chelæ, legs, great and small, all have the same form and position, that is, the laterally compressed claws all open vertically with an inclination outward. It, therefore, follows that the position of the great 'forceps' has been reversed by a rotation through 90°, in consequence of which their inner or anterior faces have become their under sides. With crayfishes, in which the metamorphosis is far more abbreviated, the adult form is already acquired at birth, so we may infer that this change has occurred in the embryo, for otherwise we should have to assume that the ancestors of the crayfish possessed another type of claw, which is not the case.

In the crayfish about one quarter of the weight of the animal is represented by the great chelipeds, while the proportional weight in the lobster is one half. The acquisition of size and strength in these limbs, and in *Homarus* the remarkable differentiation into toothed and crushing forceps of right or left sides, have been attended by a permanent torsion, which has chiefly affected the carpodite or fifth point. As can be clearly shown, however, this twisting is entirely independent of the form or weight of the claw. Meanwhile the eight slender legs have remained stationary, retaining their larval form and position.

The rotation of the chela in the lobster is completed at the fourth molt, which marks the most striking leap in the history of development. The change is unquestionably of very ancient origin, and is probably older than autotomy, which precedes regeneration in certain limbs, since fusion of the second and third joints does not occur until after the fifth stage. It was already perfected during the Liassic period in the Erymoid crustacea, which are regarded as the direct ancestors of modern crayfishes and lobsters.

Torsion in the crustacean limb can not be explained on Lamarckian principles, since, owing to the peculiar structure of the segmented limb, with its fixed hinge joints, the muscles of a given segment can deliver only straight pulls on the next distal segment, which could not produce a torsion of the joint in which the muscles are lodged.

The theory of natural selection fares no better, for it is impossible to suppose that the torsion could have arisen gradually, through successive fractions of a degree, each position being more favorable than the last, and especially since in hundreds of crabs and prawns the claws open upward and outward. It seems more probable that the condition was acquired suddenly as a discontinuous variation, which has become adaptive in a minor degree.

The Growth of the Tail of the Japanese Long-tailed Fowl: C. B. Davenport, Station for Experimental Evolution, Cold Spring Harbor, N. Y.

A preliminary report on the anatomy of the tail of the fowl and the morphologic basis of the long tail. A comparison of the tails of two brothers, one of which has had the tail feathers regularly stroked, the other not.

A Problem in Degeneration: Charles B. Wilson, State Normal School, Westfield, Mass.

The group of parasitic copepods affords one of the very best opportunities for

studying degeneration and the problems connected with it. For the phenomena are not exhibited here as isolated examples, but as a continuous series in which every step can be traced clearly. This, supplemented by a study of the life histories of the different species, gives a first knowledge of factors and conditions which aids greatly in the drawing of rational conclusions.

One of the problems is that which concerns the cause, or rather the causes of degeneration. Parasitism, while serving as a stimulus or ultimate cause, can not operate directly in producing degenerative changes. There must be other more immediate causes which operate in connection with it.

These immediate causes have been studied but very little; most writers are content with the mere statement that the disuse of a part or organ is what leads to its deterioration and ultimate loss. But evidently there must be some reason for the disuse, and then if its effects are to be permanent, and to go on accumulating until they result in the entire disappearance of the part, they must be capable of inheritance.

As a contribution towards the settlement of this and other vexed questions a careful study of the conditions and phenomena of degeneration has been undertaken in connection with the study of the morphology and habits of these parasites.

At present the study has extended over the family Argulidæ and the subfamily Caliginæ, with the following results:

1. The Argulidæ show no signs of degeneration; there are many modifications of organs in adaptation to new conditions, but nothing that could be called a deterioration. The reason for this is found in the fact that they do not carry their eggs in cases but deposit them upon some convenient surface. An act so important to the preservation of the species calls for a complete preservation of all the powers possessed by free-swimming forms.

2. Of the Caliginæ, some show as little evidence of degeneration as the Argulidæ, while others furnish excellent examples of it.

The first step in this degeneration is a loss of the lunulè, or sucking disks, on the frontal plates. Many causes contribute to produce this effect. The eggs are carried in cases and so retard locomotion; they are aerated by the movements of the host and so do not require movement on the part of the female; the best food supply is situated where there is the best aeration, so there is no incentive to movement.

3. The second step in degeneration is the assumption of a fixed position; here again several causes may be found. The larvæ are attached to the host by a frontal filament and after maturing have no incentive for moving about. On the disappearance of the lunules the second antennæ and second maxillipeds are enlarged and their claws serve for attachment organs. Claws can not be attached and loosened readily, but when once fastened securely there is a tendency to retain the hold.

The driving in of the claws makes a wound and causes a flow of blood, the food of the parasite; it is easier to lacerate the old wound than it is to make a new one; and again the deeper the wound the more plentiful the blood-supply.

4. The third step in degeneration is the modification of some part or organ in consequence of the fixed position. For each of these changes there are separate causes.

Notes on the Development of the Gill in Mytilus: EDWARD L. RICE, Ohio Wesleyan University.

The early development of the gill of *Mytilus* was worked out by Lacaze-Duthiers in 1856. To his account of the development of the earlier filaments the present

writer has nothing to add. As described, a papilla is formed, grows downward from the gill axis, and is reflexed on itself, giving rise to the familiar U-shaped filament.

Later filaments follow a very different scheme, there being no such bending of an originally simple filament. At the posterior end of the curiously curved gill axis a series of thin transverse ridges are developed. At first the edge of each ridge is entire; but growth is early checked in the center, so that the ridge is divided into two flat, rounded lobes, corresponding respectively to a filament of the outer and one of the inner gill plate. As each lobe elongates it becomes perforated at its proximal end, thus being resolved into the two branches of a U-shaped filament, identical in form with those first developed.

An interesting parallel is seen in the development of the interlamellar connections. The interlamellar connection, in its finished form, is a simple bar, containing a blood channel, and connecting the two branches of one filament. In an early stage of development the two branches of the filament are connected by a continuous plate of tissue, extending from the bend of the filament upward for a short distance. This stage is closely comparable with the adult condition in *Modiola* and *Arca*. Later a perforation appears in this plate, and the portion isolated above the perforation is transformed into the characteristic bar-like connection. The results derived from the study of isolated filaments have been confirmed by the study of sections.

The Effect of a Freezing Temperature on the Development of the Frog's Egg: T. H. Morgan, Columbia University. No abstract.

Latent Characters and Reversion: W. E. Castle, Harvard University.

1. The coat of the wild guinea-pig contains at least two pigments, black and yellow, on the same hairs. In certain varieties of domesticated guinea-pigs occur (*a*) black only, (*b*) yellow only or (*c*) neither pigment (albino variety).

2. These color types obey Mendel's law in heredity. In the order named (wild, black, yellow, albino), each type dominates all which follow it and is recessive to all which precede.

3. A recessive character disappears when brought into the same zygote with the corresponding dominant, but reappears distinct in half the gametes formed by the hybrid zygote. Hence recessive characters may exist unseen in individuals apparently dominant, but are bound to reappear if hybrid dominants are bred *inter se*.

4. Dominant characters also may exist unseen in recessive individuals, but the conditions of their reappearance are quite different. Such unseen (not recessive) characters may be called *latent*. Mating of recessives which contain latent dominant characters ordinarily produces only recessive individuals. Cross breeding with the dominant type is usually necessary to bring latent characters into activity, though in some cases where the latency was partial only, cross-breeding of two different recessive stocks has accomplished this result.

5. Albino guinea-pigs, mice and rabbits, transmit *latent* specific pigment characters (as black or yellow). This can be demonstrated by cross-breeding. Smooth-coated guinea-pigs may contain, in a condition of almost if not complete latency, the dominant rough or rosetted coat.

6. Reversion (or atavism) is a name which has been given to the reappearance in a race of lost ancestral characters. The matter has always been more or less mysterious, but would seem to consist in large part, if not exclusively, in the becoming active of characters which are latent. For this process cross-breeding seems normally to be essential, its function being either to

stimulate dormant potentialities into activity, or to bring together the isolated elements of a character which in its complex form has been lost.

Artificial Parthenogenesis in Thalassema mellita: GEORGE LEFEVRE, University of Missouri.

An investigation of artificial parthenogenesis in *Thalassema mellita* has shown that the eggs of this worm can be induced to develop into actively swimming trochophores, in the absence of sperm, by immersion for a few minutes in very dilute solutions of acids both inorganic and organic. Nitric hydrochloric, sulphuric, carbonic, acetic and oxalic acids were used successfully, and in favorable experiments 50–60 per cent. of the eggs developed into swimming larvæ that could scarcely be distinguished from normal trochophores of a corresponding stage.

An egg membrane invariably forms shortly after removal from the acid solutions, and maturation, identical with the normal process, frequently occurs. In a number of cases, however, polar bodies were not extruded, but the eggs divided and eventually gave rise to trochophores without any external indication of maturation. On sectioning such eggs it has been determined that the maturation process occurs internally, the polar mitoses taking place below the surface and without accompanying cytoplasmic division. The result is that, in some cases at least, four resting nuclei are formed in the cytoplasm of the egg which represent the egg-nucleus and the nuclei of the three polar bodies. These four nuclei then come together and fuse to form a cleavage-nucleus, which, therefore, contains, in addition to the chromatin of the egg-nucleus, all the chromatin that would have passed into the polar bodies, had they been extruded.

The egg-centrosome disappears after the formation of the second polar body, and the cleavage-centrosomes arise *de novo*.

It has frequently been observed that the polar bodies continue to divide, with the result that they form a morula-like cluster of minute cells.

Cell-divisions take place mitotically, and in many cases the early cleavage is perfectly normal, although a great variety of abnormal cleavages also occur.

The larvæ arising parthenogenetically are strikingly normal in appearance and structure and exhibit the usual differentiations characteristic of the normal larvæ of a corresponding stage of development, digestive tract and mouth, prototrochal band, apical plate and flagella, etc.

Further Experiments on Self and Cross Fertilization in Ciona: T. H. MORGAN, Columbia University. No abstract.

A Few Words on What is to be Understood by 'Good' Fixation: ALEXANDER PETRUNKEVITCH, Harvard University.

The question of what is to be understood by 'good' fixation is of both theoretical and practical value. Authors disagree as to how much of what we observe under the microscope is artefact and consequently as to the trustworthiness of the conclusion drawn from it. In my opinion, as fixed material consists in artefacts only, we should learn to eliminate errors by comparison. Two errors are especially to be shunned: mistaking for true, (1) structures which result from a dislocation of cell-organs, (2) those created by the use of injurious agents. Pauli placed the alveolar structure of protoplasm in the latter group, demonstrating that colloids show no separation into two 'phases' when a normal solution of urea is added to the fixing liquid. I repeated his experiments with a great variety of agents, some of them never used before. The results are the opposite of those obtained by Pauli.

A good fixing liquid ought to have the following qualities: (1) to produce no dislocations, (2) rapid penetration, (3) to cause no overhardening, (4) not to impair staining capacity.

As a fixing liquid for general use which fulfills these requirements I recommend the following mixture:

Alcohol absol.....	200
Water	300
Glac. acetic acid.....	90
Nitric ac. pure conc...	10
Corrosive sublimate...	55 (saturated).

The objects are put in this liquid for a period of from 6 to 24 hours, then washed in 70 per cent. alcohol with iodine which must be frequently renewed; after this they can be kept indefinitely in 70 per cent. alcohol.

The Formation and Behavior of the Microzooids of Hæmatococcus pluvialis: Florence Peebles, Woman's College.

Under normal conditions the resting cells of *Hæmatococcus* produce more macrozooids than microzooids. If, however, the dead leaves and other objects upon which they live are subjected to frequent periods of rapid desiccation the number of microzooids formed is greatly increased. These microzooids can be obtained in large quantities if the mother cells are subjected, in the early stages of division, to cold and then suddenly changed to a warm temperature; or, if kept at first in the dark, and then placed in direct sunlight. They are positively heliotropic and gather in swarms on the side of the vessel that is nearest the light.

After escaping from the mother cell a microzooid swims about for twelve to forty-eight hours and then comes to rest, loses its flagella, develops a cell wall and begins to grow. After a day or two, the first cell wall is cast off and a new one forms. A large number of microzooids have four flagella, others two. Those with four have exactly the same shape but are larger than those with two. Many double individuals have been observed, and these after a short time fuse into one normal spore. Although no two microzooids have been found in the first stage of conjugation, it seems highly probable that they are gametes, and that under certain conditions conjugation takes place, and that the zooids with four flagella are zygospores.

The Evolution of Color-producing Structures in Birds: R. M. Strong, University of Chicago.

The colors of feathers from between seven and eight hundred birds were studied. The causes of colors in feathers, the nature of color characters and the evolution of color in birds were considered.

The material studied argues strongly in favor of the orthogenetic theory of evolution of color pattern by continuous variation, advocated by Professor Whitman. A great many peculiar modifications in structure and pigmentation occur in birds. Some of these produce color phenomena which often seem, at first, to be unrelated to other colors found in birds. These studies have demonstrated, however, that a perfect continuity exists between color characters. Complete series of intergrading conditions occur in single feathers, at the margins of color areas, and in allied species.

Extreme developments, like the phenomenon of iridescence, occur very generally in bird feathers, but often in incipient stages not observable except with the aid of the microscope. Colors involving complete differentiations in structure and pigmentation sometimes appear in amounts too small to effect the total color impression received by the unaided eye. These color phenomena are ordinarily perceived only when they are produced by a large propor-

tion of the feather elements for a given area on the feather.

New color characters first appear at the extreme distal end of the feather, and they may move proximally, encroaching upon other characters. Likewise new characters appear first at the distal ends of the barbules.

The History of the Germ-Cells in Pedicellina americana: LOUIS I. DUBLIN, Columbia University.

In this study the attempt was made to work out as fully as possible the history of both egg and sperm, with especial reference to the chromatin, and to compare this with the character of the chromosomes in the various somatic tissues—thus covering the entire life history of the individual. The number of chromosomes is twenty-two. These are, in the various somatic cells and in all but the last generation of oogonia and spermatogonia, distinct Vs in shape. In this last generation, however, the chromosomes are converted into rods and from the size relations, it is very probable that these have arisen through the extension of the angle in the preceding Vs to 180°. These rods split in the metaphase and passing to the poles give rise to eleven, or the reduced number of new Vs. From the rather full evidence, more particularly in the sperm history, it is beyond question that these new figures have arisen by the end to end union of the rods at the telophase of the last spermatogonial and oogonial divisions. This is for *Pedicellina* the true synapsis, and the conversion of the chromosome form from Vs to rods is in preparation for it, thus strikingly confirming the results of Montgomery and Sutton. The eleven loops thus formed grow rapidly, split longitudinally and then become extended into nearly straight thin parallel threads, the synaptic point being at the middle. The chromosomes now contract and form themselves into double rods, ellipses and rings, and as such enter into the first maturation spindle. From the complete history of the individual chromosomes up to this point and the ease with which the synaptic point may be followed this division is undoubtedly the reducing one, separating the chromosomes which had united at the synapsis. The second division is longitudinal and the maturation processes are completed.

Color Changes in Anolis: G. H. PARKER and S. A. STARRATT, Harvard University.

Anolis carolinensis, according to Carlton, changes in the dark from brown to green in about twenty-five minutes, and in the light from green to brown in about four minutes. Temperature, however, was found to influence this rate. Thus in the dark at 10° C. the lizards remained brown; at 20° they changed to green in about 20 minutes; at 25° in about 13 minutes; at 30° in about 11 minutes; at 35° in about 15 minutes; and at 40° and 45° they were always green. In the light at 10° they also remained brown; at 20° they turned brown in a little over 4 minutes; at 25° in about 3.5 minutes; at 30° in a little over 3 minutes; at 35° in about 2.8 minutes; and at 40° and 45° they were always green. Thus a low temperature induces brown and a high one green and both are independent of illumination.

The changes from green to brown and the reverse take place at temperatures where light is an effective stimulus when the lateral eyes and the pineal eye are artificially covered. A beam of light about a millimeter in diameter and thrown upon the skin is all that is necessary to induce the change from green to brown. The nerves of the skin of *Anolis* must, therefore, be sensitive to light.

Organ-forming Substances in the Eggs of Ascidians. Illustrated by Photomicro-

graphs of Living Eggs by Katharine Foot and Ella C. Strobell: Edwin G. Conklin, University of Pennsylvania.

Three very different kinds of protoplasm may be observed and photographed in the living ovocytes and unsegmented eggs of *Cynthia partita;* these are the yellow *mesoplasm* which later enters into the mesoderm, the gray *endoplasm* which gives rise to the endoderm, and the transparent *ectoplasm* which becomes ectoderm. Three additional differentiations are visible and have been photographed before or immediately after the first cleavage, viz., the mesoplasm is differentiated into a deep yellow substance, the *myoplasm,* which gives rise to the muscles of the larva and into a light yellow material, the *chymoplasm,* which becomes mesenchyme; there is also recognizable an area of light gray material, the *chorda-neuroplasm,* which develops into the chorda and neural plate of the larva.

As early as the close of the first cleavage all of these substances are localized in the egg in positions corresponding to those which they will occupy in the embryo or larva; the mesoplasm forms a yellow crescent around the posterior side of the egg dorsal to the equator, the chorda-neuroplasm takes the form of a gray crescent around the anterior half of the egg, the endoplasm lies between these two crescents at the dorsal (vegetal) pole of the egg, the ectoplasm occupies the ventral (animal) hemisphere. The dorsal border of the yellow crescent consists of light yellow protoplasm (chymoplasm), which gives rise to the mesenchyme of the trunk, while a similar area of light yellow or clear chymoplasm lies at the middle of the crescent behind and ultimately forms the caudal mesenchyme of the larva. All of these areas and substances can be followed with ease and certainty throughout the development until they enter into the principal organs of the larva, a fact which is beautifully shown by the photomicrographs.

Experimental Studies on the Ascidian Egg: Edwin G. Conklin, University of Pennsylvania.

That the various areas and substances of the ascidian egg are actually organ-forming ones may be demonstrated by experiment. Operations on the unsegmented egg inhibit development, but when certain blastomeres of the cleavage stages are killed or injured the ensuing development of the uninjured blastomeres is strictly partial; in no case do such blastomeres give rise to other organs than those which they would have produced under normal conditions. Conversely, if the cells which contain the myoplasm are destroyed the resulting larva has no muscle cells; if the cells containing the chorda-neuroplasm be removed there will be no chorda nor neural plate in the resulting monster; the same is also true of the ectoplasm and endoplasm.

Since all these substances are divided bilaterally at the first cleavage, each of the first two blastomeres contains one half of all of the organ-forming substances, and inasmuch as isolated blastomeres of the ascidian egg produce rounded masses of cells which tend to close over the injured part, it frequently happens that the half embryo or larva bears a superficial resemblance to a whole one; however, a study of their cell-lineage and later development shows that they are still half embryos and larvæ. When the egg is injured along any other plane than the median one nothing even remotely resembling a normal larva is ever produced.

Prophases of the First Maturation Spindle of Allolobophora fœtida: Katharine Foot and E. C. Strobell.

At the end of the growth period, the chromatin granules which are distributed

throughout the germinal vesicle segregate into an extremely fine spireme. This spireme becomes shorter and thicker, and shows a distinct longitudinal split. It then divides *transversely* into eleven bivalent chromosomes, *i. e.*, in each case two univalent chromosomes remaining attached end to end. There is no conjugation of univalent chromosomes; it is merely a question of two univalent chromosomes already attached in the spireme remaining so, this causing the numerical reduction to half the somatic number.

The two univalent chromosomes of each of the eleven bivalent chromosomes are still attached end to end at the metaphase of the spindle, and the longitudinal split seen in the spireme of the earlier stage persists until this period, causing typical tetrads, *i. e.*, bivalent chromosomes with a longitudinal and a transverse furrow. These chromosomes separate along the line of the *transverse* furrow (which indicates the point of attachment of two univalent chromosomes). *Allolobophora* thus supports the observations of Korschelt in the annelid *Ophryotrocha*, and Montgomery and others who maintain that the first division separates univalent chromosomes and is, therefore, a reducing division.

There are two nucleoli in each germinal vesicle, the relatively large *principal nucleolus*, and the smaller *accessory nucleolus*, and neither appears at any time to be a storehouse for the chromatin which forms the chromosomes. The principal nucleolus disappears before the spindle is formed, but the accessory nucleolus may persist until much later.

We interpret the accessory nucleolus as the precocious appearance of the nucleolus of the oocyte of the second order. If, as held by a number of investigators, the chromosomes of one division are in some manner related to the nucleolar substance of the following rest stage, may not this take place at an earlier period, and the accessory nucleoli of the germinal vesicle be a precocious appearance of the nucleoli, which are so conspicuously absent between the first and second maturation spindles, the processes involved in the rest stage occurring before instead of after the first division, and the origin and growth of the accessory nucleolus being part of them? The second division precociously foreshadowed in the four-part chromosome of the germinal vesicle suggests a precedent for this interpretation.

A Quantitative Study of Holothuria atra Jäger and the Reestablishment of Holothuria floridana Pourtalés (=Holothuria mexicana Ludwig): CHARLES LINCOLN EDWARDS, Trinity College, Hartford, Conn.

Jäger, 1833, described *H. atra* from Celebes. Pourtalés, 1851, described *H. floridana* from Florida. Semper, 1868, gave *H. floridana* as a synonym of *H. atra* and since then all authors have followed Semper. Ludwig, 1875, described *H. mexicana*. Clark, 1901, gave Porto Rican specimens as *H. mexicana*. Ten of these specimens identified by Clark are included in my statistics and they are *H. floridana* as defined in this paper. Statistical analyses of 138 specimens, 20 from the Sandwich Island-Mozambique and 118 from the Florida-Caribbean region clearly demonstrate that *H. floridana* Pourtalés should be reestablished as a species distinct from *H. atra* Jäger, and that *H. mexicana* Ludwig is a synonym of *H. floridana*. In general, biometry offers a most important method in taxonomy for determining the extent of variation and, therefore, of the best (least variable) specific characters and their proper definition, together with the separation of growth from adult characters. The following comparison gives in brief résumé the chief differential characters:

H. atra.	*H. floridana* (= *H. mexicana*).
Color mostly uniform seal-brown.	Color very variable. Shades of brown like seal, clove, Vandyke, etc., and of gray, cream, buff, etc. Often beautifully marbled. Young generally lighter.
'Pits' in skin. No 'warts.'	'Warts,' each a heap of spicules usually surmounted by a conical papilla, generally present, especially in young. No 'pits.'
Skin flaccid. 1–1.5 mm. thick. 25 per cent. of dorsal ambulacral appendages are pedicels; the rest papillæ. 5 types of calcareous end-plates from large, well developed, associated with the cylindrical pedicels to small, vestigial with the conical papillæ.	Skin firm, 2–5 mm. thick. 80 per cent. of dorsal appendages are pedicels; of the remainder not all are true papillæ. Much larger percentage of well developed end-plates, only 1 case of the fourth and none of the fifth type.
Calcareous rosettes like crosses; central rod elongated. Longer, broader and more delicate.	Calcareous rosettes stellate; central rod short; branches blunt. Twice as thick as those of *H. atra.* Growth stages of the perforated plates.
Of 300 rosettes 2 had 3 holes, 4 had 2 holes and 19 had 1 hole. No well developed plates.	Special types of 4- and 8-hole plates, together with other incomplete plates, are growth stages of the fully developed plates which have 4–31 holes; mean 13–14 holes.

The number and length of polian vesicles and of stone-canals increase with age. Seventy-one per cent. of the young *H. floridana* have only 1 polian vesicle, while in the adult the number ranges from 1 to 92. The total number of stone-canals in *H. floridana* ranges in the young from 2 to 25; in the adult, from 5 to 149.

On Some Points in the Natural History of the Oyster: Ramsay Wright, University of Toronto.

The author, who has been directing the Marine Biological Station of Canada at Malpeque, Prince Edward Island, during the last two summers, exhibited some photographs in illustration of his paper. The first showed that the kidney is a much more conspicuous system of branched tubes, at least during the spawning season, than is generally supposed. The tubes extend into the pericardial wall, and into the mantle in the neighborhood thereof.

Photographs of the male and female genital ducts showed that it is possible in ripe individuals to recognize the sexes without examining the genital products. It was stated that while in oysters of three or four years' growth the sexes are equally divided, 90 per cent. of one year old oysters, which are already sexually mature, are males, a circumstance which seems to point to the protandry which has been asserted of the American oyster. A more exhaustive study of this point is required.

The occurrence of *Urastoma* (better, *Urostoma*) *cyprinæ*, Graff, a commensal turbellarian, was recorded from the oyster. It has hitherto been observed in *Cyprina islandica* from the Baltic, *Mytilus edulis* from the White Sea, and in *Solen vagina* from Trieste.

*Diversity in the Scutes and Bony Plates of Chelonia:** R. E. Coker, Johns Hopkins University.

I. *Scutes.*—There is a remarkable degree of diversity in the number and arrangement of the scutes of the carapace and plastron of certain species of Chelonia, notably *Malaclemmys centrata* (Latr.) and *Thalassochelys caretta* (L.). Of 244 specimens of *Malaclemmys,* 109 were abnormal in scutes; 20 per cent. had either more or less than the typical number of carapace scutes. About one half of the abnormal specimens were asymmetrical.

Neither in observations on *Malaclemmys* nor in those on 26 embryos from a single nest of *Thalassochelys,* was support found for Gadow's theory of 'orthogenetic variation.' For example, the embryos averaged, per carapace, a fraction less than the typical number of scutes.

Rare instances are found of a peculiar form of variation that may be termed 'orthogenetic.'

II. *Correlation.*—The normal correlation of scutes and plates is, roughly, a modified alternation, the alternation being especially simple in the marginal series. The corre-

* Presented with the permission of Hon. Geo. M. Bowers, U. S. Commissioner of Fish and Fisheries.

spondence of marginal plates with sutures between scutes is retained in several shells abnormal in the marginal region. In the costal series the seventh forms an exception: but it harmonizes with the others falling into the alternating series, and bearing the triradiate impression of scute sutures in several specimens that have a supernumerary neural in the posterior region. In shells abnormal as regards scutes, the normal condition of correlation may tend to be preserved by associated (correlated) abnormalities in bony plates.

The presence, in correlation with supernumerary scutes, of a ninth costal plate may be an atavism. In such cases observed, the tenth rib, instead of as normally anchylosing with the ninth rib and eighth costal plate, enters into the ninth costal plate; so that each dorsal rib, except the first, forms part of a plate.

More complete results, with drawings and photographs, are in preparation for publication.

On the Nature and Behavior of the Morphogenous Substances in the Egg of Chætopterus: FRANK R. LILLIE, University of Chicago.

Eggs of *Chætopterus* may be stimulated to undergo differentiation of certain kinds without the process of cleavage by a variety of methods. Such unsegmented ova develop cilia and swim about actively. The protoplasm is vacuolated like that of the normal larvæ and the yolk is aggregated in a manner resembling that in the normal development.

Careful examination of this mode of development, however produced, showed that it proceeds by the segregation and differentiation of substances readily distinguished by their optical properties and by their behavior. The sequence of events is somewhat obscured and complicated by amœboid movements of the protoplasm, but is essentially the same in all ova. Five separate substances may be readily distinguished, arranged like a series of strata, prior to the appearance of the cilia; one of these overflows the remainder and cilia develop from this layer alone, which is characterized by the presence of peculiar granules.

The same substances may be recognized in the normal unsegmented egg where they have a different arrangement, and they may be followed in the normal development. They thus appear to be specific in their morphogenic properties, both in the normal and in the modified development. Morphologically these substances are distinguishable only by differences in the size, arrangement and microchemical reactions of the larger spherules, and not at all by local differentiation of the microsomes or ground substance of the protoplasm. The conclusion appears inevitable that in *Chætopterus* at least, the differences between specific morphogenic substances are dependent, certainly in part, on the nature of the spherules contained.

The observations led to the conclusion that these spherules exhibit attractions and repulsions among themselves, which may, to a great extent, explain their segregation and arrangement.

The spherules have all been lumped together as 'yolk' in the egg of *Chætopterus.* In other animals, also, is the so-called yolk really a mixture of various substances? It is in any event certain that we have no precise criterion of yolk in holoblastic eggs, and one is badly needed.

The Structure of Bothriolepis, with Exhibition of Specimens of Devonian Fishes of Canada: WILLIAM PATTEN, Dartmouth College.

This paper was based on a large collection of new material recently acquired by the author from New Brunswick. Numer-

ous specimens illustrating the mode of life and especially the structure of the mouth-parts were exhibited.

The Color-Pattern of Nanemys guttata Schneider (a preliminary report): Robert M. Yerkes, Harvard University.

1. The young of this species of tortoise usually have a single yellow spot on each plate of the carapace, except the marginals. With age the number of spots increases, they appear on the marginal plates also, and their arrangement becomes irregular.

2. The epidermal layer is transparent immediately over the mass of yellow pigment in the outer bony layer, hence, window-like regions in the outer portion of the shell.

3. Although the females are slightly smaller than the males they usually have about 15 per cent. more spots on the carapace. The average number for the males is 60, for the females 69. This would seem to indicate that the brightly colored spots serve as both sex and species marks. Probably they serve to render the females conspicuous.

4. Statistics indicate a greater number of spots on the left side of the carapace than on the right in both males and females. It is possible that this is to be correlated with right-handedness and right-eyedness.

Chromosome Vesicles in the Maturation of Nudibranchs: W. M. Smallwood, Syracuse University.

Between the anaphase of the first maturation and the prophase of the second the chromosomes pass through some important changes. The first indication of the presence of vesicles is noted at about the time that the young amphiaster of the second maturation figure is forming and moving into a radial position. At this time a distinct membrane appears around each chromosome, which lies so close to the chromosome as to be overlooked in some instances. It frequently happens that one chromosome vesicle contains two or more chromosomes, in which case the chromosomes are united by narrow strands of chromatin.

The chromosomes do not always pass into vesicles, but go through the well-known changes as described for other molluscs, annelids, etc.

During the prophase of the second maturation the solid chromosomes enclosed in vesicles may lose their reaction to basic stains almost entirely, with the result that each vesicle represents in miniature a nucleus having chromatic granules, linin threads and an achromatic substance. After this condition the granule, or granules, within the chromosome vesicle increases in size until it has the normal appearance of a chromosome lying in the cytoplasm. It is an open question as to the fate of the surrounding vesicle.

The fibers constituting the second maturation spindle are formed in part of the eggs from the cytoplasm after the spindle has taken a radial position and the centrosomes are fully differentiated into centriole and centroplasm.

The chromosomes which pass into the first and second polar cells may each have a separate vesicle or all of the chromosomes may pass into one vesicle. All combinations between these two extremes occur.

These and similar results on *Haminea* suggest that the chromatin passes through a liquid state during maturation, at which time there may be a complete chemical rearrangement of the molecules in the chromosome, which, if it were true, would interfere to some extent with the theory of the qualitative division of the chromosomes.

The complete paper will appear in the *Morphologisches Jahrbuch,* Bd. XXXIII.

Experimental Studies of Adaptation and Selective Elimination in Fishes: FRANCIS B. SUMNER, College of the City of New York. No abstract.

Habits and Reactions of Crabs bearing Actinians in their Chelipeds: J. E. DUERDEN, University of Michigan.

Möbius in 1880 first made known the fact that the crab, *Melia tessellata* Latr., has the remarkable habit of carrying a living actinian in each claw. The polyps are carried about in front of the crab, held in a kind of defensive attitude, and it is assumed that the actinians, by means of their stinging threads, may be useful to the crab for purposes of offense and defense, while the activity of the crab may serve to bring the actinian into the neighborhood of more prey. During a recent visit of the writer to the Hawaiian Islands, under the auspices of the Carnegie Institution, two specimens of *Melia,* both bearing an actinian in each claw, were collected, and observations made upon their habits and reactions. These may be summarized as follows:

1. The commensalism is not restricted to a single species of actinian. One crab carried a *Bunodeopsis* and the other a Sagartid. The species are interchangeable, and the crabs will dislodge a small polyp to take up a larger. Apparently the crab is not aware of the presence of an actinian until it comes in actual contact with it; dislodgment of a fixed actinian is brought about by means of the first pair of ambulatory limbs.

2. When irritated the crab moves its chelipeds so as to place the actinians in such a position as to best serve as a means of defense. Food given the polyps is abstracted by the crab by means of its first pair of walking limbs, the stimulus to activity being probably derived from the diffusion of the meat juices.

3. *Melia* has lost the direct use of its chelipeds as organs of defense and offense, or for grasping objects other than the actinians; in correlation with this the functions of the first ambulatory appendages have become largely modified.

4. A second species of crab, *Polydectus,* was also found which bears an actinian, *Phellia,* in its chelipeds.

On the Structure of the Larval Oyster and its Occurrence in the Plankton: JOSEPH S. STAFFORD, McGill University. Read by title.

A Statistical Study of Correlation and Selection in Lepidoptera: HENRY E. CRAMPTON, Barnard College. Read by title.

HENRY S. PRATT,
Secretary.

SCIENTIFIC BOOKS.

Vorlesungen über Pflanzenphysiologie. LUDWIG JOST. Jena, Gustav Fischer. 1904. Pp. xiii + 695; 172 figures.

In the form of forty odd lectures the author presents a comprehensive view of the whole field of plant physiology. In the preface he states that it is his purpose to supply, in this volume, a book for the student, which will fill the gap between Pfeffer's exhaustive treatise and the short accounts found in various general text-books. In this he has succeeded and has filled a long-felt want for the reader who wishes a full, but not too detailed, account of the important facts and problems of plant physiology. There is a departure from the usual mode of treatment, in that the subject is divided under three main heads, instead of two. The first of these concerns the chemistry and nutrition of the plant and occupies somewhat less than half of the book. The rest is about equally divided between a section entitled 'Formwechsel,' treating of growth and reproduction, and another entitled 'Energiewechsel,' which has to do with movements of both growth and locomotion.

In general the treatment of nutrition does not differ materially from that of many other books, except that it is fuller. Under the general term assimilation is considered both