ever-present injuries to farm products cause conditions for pathological study. Many diseases are transferred from plant to plant by animals of nearly all classes, and the combined efforts of zoologists and of pathologists will be necessary to combat this evil. Dr. Erwin F. Smith enumerates bees, the potato beetle, snails and slugs as known transportation agents for various diseases. Moreover, we do not yet know how many diseases of animals, both domesticated and wild, may be due directly or indirectly to plant diseases. Cases have been reported where serious results have attended the feeding of diseased fodder to live stock; and flour, made from infested grain, may cause serious results in man.

The relations between plant pathology and chemistry are perhaps more intimate, but at first glance less apparent than those already noted. The most obvious connection is through the work which the chemist and the pathologist have done together in developing the manufacture and the use of fungicides. To the farmer, this has seemed the most practical side of pathological work, because of the immediate results in saving crops. A less noticeable but even more important contribution of chemistry is the analysis of soils and of fertilizers, by which we can better know the conditions of optimum growth for various crops, and the best conditions for growing plants which are resistant to disease. The good resulting from this kind of investigation can not be overestimated, for, as a man in good physical condition is able to resist the attacks of many diseases, so a plant, if given the best conditions for growth, will be able to combat the various parasitic organisms which would otherwise destroy it. In another way chemistry will prove in the future a valuable ally in studying plant diseases. In the healthy plant certain products of growth are formed whose chemical nature must be known. When the plant is diseased, these organic compounds, acted upon by the enzymes produced by the attacking organism, or otherwise changed in composition, must be examined again to determine the nature of the change.

The relations existing between plant pathology and physics are not so well defined as in the cases already cited. If, however, we keep in mind that there is, in the study of botany, a physical as well as a physiological side, these relations are more easily seen. The ascent of water in trees; the conduction of water, food-elements and foods, and reaction to gravitation and to other physical stimuli are problems which the physicist must aid us in solving, though connected with these there are undoubtedly many vital processes which modify the mere physical forces. In a diseased plant the effects of these physical forces are modified probably more than we now realize. We may mention as examples of these modifications the stoppage of water-conducting elements in woody plants, the weakening of the tenacity of wood, and similar changes in the physical conditions of plants.

This is not the place to state more definitely the problems in plant pathology waiting to be solved with the aid of other sciences, but we may note in closing that in the past the interrelations of the sciences have not been entirely disregarded, for such men as Pfeffer and Pasteur, by using methods of sister sciences, have made valuable additions to our knowledge of botany.

Ernest Shaw Reynolds

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
SECTION F—ZOOLOGY
THE AMERICAN SOCIETY OF ZOOLOGISTS
II

Inheritance of Comb Form in Poultry: C. B. Davenport, Carnegie Station for Ex-

perimental Evolution, Cold Spring Harbor, N. Y.

Genetics in Swine Hybrids: Q. I. and J. P. SIMPSON, Palmer, Ill.

In the year 1896 the writers began experiments with swine for economic results and for determining the relative potential of sex; but the uncovering of Mendel's laws has since broadened our inquiry.

The material has comprised nine pure and distinct breeds.

Two breeds, although of identical color, do not act alike under hybridization, showing a difference in their color determiners.

Combinations are made where coat color is full dominant, but skin color complete recessive, in the same animal.

We find the wild *sus scrofa* full dominant over every observable character and instinct of the Tamworth—even fooling the naturalists.

The solid hoof of the "Arkansas Mule Foot" is dominant over normal breeds; but intermediate grades of hoof are made at will.

Examples are shown of a transferrence of color, following shedding of the hair; of finely mingled roans; of segmented coloring of individual hairs (like the banded hairs of the wild Texas peccary), all showing that two colors may exist in the same cell—one of them passively awaiting its biochemic stimulus.

Instances are noted of the testes acting as this stimulus and, from the apparent mass of evidence, that color may exist in cells, unexhibited, is drawn a conception that seems to emasculate the "allelomorph to its absent" theory, now held by some renowned experimenters.

Of two red breeds, identical in tint, crossed with a white breed, one produces roans only; while the other makes only mosaics, showing that the first red breed is of solid color origin, and the last, of pattern origin. And the known history of each confirms this.

Color quantity in the individual is in ratio to the sum of its parents' colors.

A cause for the white belt in horse, swine, ox and India tapir is thought to be embryonic, and its more anterior location on swine is ascribed to blastomere divergence between these species.

Among the nine breeds used in hybrid experiments, it was discovered that some breeds would pair with equal color-potential. And the broods from these exhibit two distinct classes, equally divided, indicating the slightly inexact division of a chromosome in the oogenesis or spermatogenesis of a parent; and when confirmed by further experiment will show a fruitful cause for variation, within a breed or species.

We have found to be absolute, the Mendelian reseparation of units in swine color-hybrids.

When we say that with morphologic and color units the breeder may now add, combine and fuse, can extract, precipitate and analyze for purity—as with chemicals—that he may almost create designs at will, it is not said in egotism; but in profound acknowledgment to you men of science who show the way. And whilst the breeder's interest is not uppermost in your research of nature's evolution, his gratitude is none the less.

Report on Some Experiments in Transplanting Species of Leptinotarsa into new Habitats, with Remarks upon the Significance of the Mode: W. L. TOWER, University of Chicago.

Inheritance of Crest and Color in Canaries: C. B. DAVENPORT, Carnegie Station for Experimental Evolution, Cold Spring Harbor, New York. (Published in *Proceedings* of the Eastern Branch.)

A Litter of Short-tailed Dogs: R. M. Strong, The University of Chicago.

A fox-terrier bitch gave birth on October 31, 1907, to five pups—four males and one female. One of the males had practically no tail, and the other pups had short tails of various lengths. The tails were measured on November 28, as follows: The female and one male had tails measuring about $1\frac{1}{4}$ inches. A third male had a tail $2\frac{1}{2}$ inches long, and the fourth male's tail measured 4 inches. The female and the tailless male are being reared for breeding studies. The mother's tail is short, and it has the appearance of having been cut at some time. The male parent is unknown, and the condition of the mother's tail at birth has not yet been satisfactorily determined.

Some Stages in the Embryology of certain Degenerate Phoridæ and the supposedly Hermaphroditic Genus Termitoxenia: Charles T. Brues, Public Museum, Milwaukee, Wisconsin.

The family Phoridæ form an interesting group of Diptera on account of a number of genera which are partially or wholly wingless in the female sex, and very degenerate in other respects.

The oogenesis of a species of the Texan myrmecophilous genus *Ecitomyia* was studied and compared with that of *Termitoxenia,* another form of aberrant Phoridæ which has been investigated by Wasmann. The resemblance is very close and serves to confirm the writer's opinion of the close relationship between *Termitoxenia* and other Phoridæ.

The gross features of the embryology of *Termitoxenia* were studied and found to present no remarkable divergence from the same stages in some other Diptera. They do not confirm the supposition of Wasmann that these insects give birth to the imago stage with a suppression of the larva and pupa, since the oldest embryos found are no farther advanced than those of certain viviparous flies like *Sarcophaga,* which give birth to living larvæ.

The writer could find no evidence in support of the hypothesis that these animals are hermaphroditic.

Suggestions for a Natural Classification of the Family Lymnæidæ: Frank Collins Baker, Chicago Academy of Sciences.

The fresh-water pulmonates have been gradually undergoing the splitting process so notably carried out in the land snails by Pilsbry, Dall and others. The family Lymnæidæ contained, until recently, the genera *Lymnæa, Planorbis, Physa* and *Ancylus,* besides several other small genera. *Ancylus* and *Physa* have been separated, forming the families Ancylidæ and Physidæ, each characterized by peculiarities of shell, radula and genitalia. Of the old Lymnæidæ there still remain *Lymnæa* and *Planorbis,* each falling into a sub-family. A study of these two groups seems to point inevitably to their separation into two families, Lymnæidæ and Planorbidæ, the former having a long-spired shell, a unicuspid central tooth, bi- or tri-cuspid lateral teeth, and the male genitalia with strong muscles protracting and retracting the male organ, which forms a distinct penis and penis sac. In Planorbidæ the shell is discoidal, the central tooth is bicuspid, the laterals are tricuspid, with a modified mesocome in the typical genus, and the male organ is destitute of the strong muscles of *Lymnæa* and is not strongly differentiated into penis and penis sac. In *Planorbis* the tentacles are long and filiform while in *Lymnæa* they are flat and triangular.[1]

As thus restricted, the Lymnæidæ present a homogeneous group of snails which may be divided into several genera and

[1] Pompholaginæ will probably also be found to rank as a family.

subgenera. Generic characters may be found in the genitalia (shape of prostate, relative size and form of penis and penis sac) the radula and the shell. It was found upon studying the genitalia that the groups *Radix, Megasoma, Galba* and *Acella,* which had been founded upon shell characters, could also be distinguished by differences in the genitalia.

Only the North American species have been critically examined;[2] the application of the above criteria results in the following tentative classification:

Family LYMNÆIDÆ Broderip. 1839

Subfamily Lymnæinæ Dall. 1870

Mantle margins retained within margin of shell.

Genus *Lymnæa* Lamarck. 1799. Type, *Helix stagnalis* Linné.

Genus *Pseudosuccinea* Baker, nov. Type, *Lymnæa columella* Say.

Genus *Radix* Montfort. 1810. Type, *Helix auricularia* Linné.

Subgenus *Polyrhytis* Meek. 1876. Type, *Limnæa kingii* Meek.

Genus *Bulimnea* Haldeman. 1841. Type, *Limnæa megasoma* Say.

Genus *Acella* Haldeman. 1841. Type, *Limnæa haldemani* (Desh.) Binney.

Subgenus *Pleurolimnæa* Meek. 1866. Type, *Limnæa tenuicostata* M. & H.

Genus *Galba* Schrank. 1803.

Subgenus *Galba* (typical). Type, *Buccinum truncatulum* Müller.

Subgenus *Stagnicola* Leach. 1830. Type, *Buccinum palustre* Müller.

? Subgenus *Leptolimnæa* Swainson. 1840. Type, *Buccinum glaber* Müller.

Subfamily Amphipepliidæ Baker, nov.

Mantle margins enlarged, covering a portion of the shell.

Genus *Amphipeplea* Nilsson. 1822. Type, *Buccinum glutinosum* Müller.

Genus *Cyclolimnæa* Dall. 1905. Type, *Limnæa involuta* Harvey.

[2] Several foreign genera are not here included, as their anatomy is unknown. The study of these genera will not, it is believed, materially change the outline here presented.

Pigmentation in the Feather Germs of a White Ring-dove Hybrid: R. M. STRONG, University of Chicago. (Read by title.)

The Sense of Smell in Birds: R. M. STRONG, The University of Chicago.

This is a preliminary report of investigations that are not yet completed. The olfactory sense was studied in buzzards and ring-doves, but principally in the latter. The behavior of four ring-doves with reference to the odors of cologne, violet sachet powder, and oil of bergamot, was observed with the aid of a labyrinth. This apparatus was provided with four apartments opening into a central square enclosure. The doves were fed twice a day in one of these apartments which was chosen at random. An odor was driven out of the chamber containing the food, into the central enclosure, by a gentle air current. Similar air currents emerged from the other apartments as controls. An air exhaust was located at the center of the apparatus. The labyrinth was ventilated after each feeding, and this series of experiments has been continued for about three months.

A significant but not regular improvement in the accuracy of finding the food was observed. The conclusion reached is that birds may be stimulated by the odors employed, but it is also probable that little use is made of olfactory stimuli.

A morphological study of the olfactory apparatus of birds is in progress.

The Anatomy of a Typical Pennatulid: C. C. NUTTING, University of Iowa.

A demonstration with lantern slides of the use of photography of objects under water in illustrating the gross anatomy of an alcyonarian, and also the first detached

description of the structure of a pennatulid. (Monograph in progress.)

On the Distribution of Certain Salmonidæ in Wisconsin: GEORGE WAGNER, University of Wisconsin.

A discussion of the occurrence of the lake trout and certain Coregoni in Wisconsin, with special reference to the physical characters of the lakes concerned.

The Process of Heredity as Exhibited by the Development of Fundulus Hybrids: H. H. NEWMAN, University of Michigan.

In the spring of 1905 the writer, after familiarizing himself with the experimental work on heredity of the last decade or so, came to the conclusion that this work dealt too exclusively with definitive characters and scarcely at all with the origin and development of these characters. Being firmly convinced that heredity is essentially a developmental phenomenon, it seemed necessary to make a study of the process of heredity as exhibited in living embryos, watching for the origin of characters and studying their development in pure bred and hybrid forms.

Very favorable material was found in two species of killifish, *Fundulus heteroclitus* and *F. majalis*. These offered sufficiently wide differences morphologically and physiologically, in eggs, embryos and adults, for experimental study. The most important differences for the study of heredity in early development were differences in size and protoplasmic content of the ova; in time rate of development; in quality, distribution and time of appearance of pigment; in rate and time of establishment of the heart rhythm; in resistances to unfavorable conditions; and the inter-influences of these and other characters.

The following are some of the results obtained:

1. The influence of the sperm of the less rapidly developing species showed a measurable retarding effect upon the egg of the more rapidly developing species in a comparatively short time, usually after about eighteen hours, at which time the blastodisc is beginning to spread out over the yolk. In the reciprocal cross there was a somewhat later, but just as marked, accelerating effect.

2. The influence of maternal and paternal factors was not of constant potency, but alternating waves of parental influence emphasized the fact that heredity is essentially a process involving rhythms of parental influence and constant flux of characters.

3. Certain dominant and hyperdominant characters were shown to be the secondary physiological effects of a primary blending of characters, or, as the necessary result of mere mechanical restrictions, such as size of egg membrane or amount of yolk available.

4. In order to avoid all sorts of complex and contradictory conditions, it was found necessary to equalize the physiological conditions of the parents. Only males and females freshly brought in and at the height of their spawning activities, would give even approximately uniform results in different experiments.

5. It was also found necessary to equalize the environmental conditions of developing embryos. Otherwise highly complex conditions arose that obscured the study of heredity.

6. In view of the fact that external factors, such as physiological condition of parents and environmental conditions of embryos, showed such a marked influence in disturbing the process of heredity, it seems necessary to emphasize the potency of external factors in heredity. Heredity seems to be in essence a developmental process, determined partly by the architecture of the germ-plasm and partly by

external conditions. If either is altered the result is an interference with ideal heredity, which may be defined as identity in process of development between parent and offspring. These two conditioning factors of heredity are of equal potency, since each is efficient only in the presence of the other.

The Rate of Growth of the Egg-yolk in the Chick, and the Significance of White and Yellow Yolk in the Ova of Vertebrates: OSCAR RIDDLE, The University of Chicago.

A method has been found by which the rate of growth of the egg-yolk of the chick may be easily measured. If the fat-stain Sudan III. be fed to laying hens at intervals of one, two or more days, the stain can be found later in the form of concentric red rings in all of the rapidly growing ova. The actual rate of growth varies widely—0 to 2 mm.; but one day of growth normally includes a layer of white yolk and a layer of yellow yolk. It is probable that the layer of white yolk represents the part which is grown during the later hours of the night, and that the yellow yolk is yolk of more rapid growth produced during the remainder of the day.

In the turtle's egg there is a concentric layer of white and another of yellow yolk for each of the four years required (Agassiz) for the complete growth of these ova. Here the yellow yolk undoubtedly corresponds to a part of the egg which is rapidly grown.

A consideration of the formation and arrangement of white and yellow yolk in the ova of the several groups of vertebrates leads to the conclusion that everywhere among these animals white yolk is yolk of relatively slow growth, and that the yellow yolk is yolk of more rapid formation.

For the more intimate explanation of the concentric layers, etc., of white yolk one must take into account two factors which seem to have been overlooked, namely, the reversible action of enzymes which in periods of hibernation or low feeding must tend to analyze and break up the large yolk granules at the periphery of the yolk; at the same time some of the newly formed products of decomposition will leave the peripheral part of the ovum and become distributed between the latter and the surrounding circulating blood according to the requirements of the partition coefficient of each of these substances.

The remarkable arrangement, and apparent elaborate organization of some of the most prominent morphological elements of the larger egg-cells thus receive their physiological explanation.

A Comparison of the Reactions of a Terranean and a Subterranean Species of Isopod: A. M. BANTA, Marietta College.

An investigation of the fauna of Mayfield's cave near Bloomington, Indiana, suggested the desirability of studying the reactions to various stimuli (light, tactile stimuli, etc.) of some cave species in comparison with the reactions to the same stimuli of a near relative living in other situations. The blind cave isopod *Cæcidotea stygia,* and the common asellid, *Asellus communis,* were selected.

It was desired to determine if the increased development of tactile organs in cave animals was accompanied by an increased sensitiveness to tactile stimulation. The experiments proved this conclusively. A second point was to determine the relative sensitiveness of the two animals to light. The cave species proved to be very little sensitive to light compared with its outdoor relative. With directive light the threshold of stimulation was about 2.2 candle-meters with *Asellus* and about 80 candle-meters with *Cœcidotea.* It was also desired to find out, if possible, what were

the factors determining the distribution of the one species within caves, while the nearly related form, though living in the same region, did not take to that habitat. Both species were found to be negatively phototropic ordinarily, and were negative to all intensities to which they responded at all; but *Asellus* after having been in darkness three hours or longer was positive in its response to any intensity to which it responded at all (2.2 candle-meters or greater intensity). This affords an explanation on the basis of reactions to light alone of the occurrence of *Cœcidotea* within caves and *Asellus* outside of caves. *Cœcidotea* responds to such intensities as to enable it to avoid daylight, while *Asellus,* after once having been in darkness for a time, is positive in its response to light, so that, while the former would tend to remain within the darkness of caves, the latter, if it got into a cave, would after a time become positive in its response to light and escape if it happened to come within reach of light from the outside. Another possible factor in determining the cave distribution of the one and not of the other species is the apparently greater discriminative power of the *Cœcidotea* in selecting food. *Asellus* takes with its food a large amount of inorganic matter, while *Cœcidotea,* living as it does where organic matter is relatively very scarce, takes only a small amount of inorganic matter with its food.

The Development of the Thymus in the Pied-billed Grebe: Charles E. Johnson, University of Minnesota. Presented by H. F. Nachtrieb.

The observations here presented are based on a study of the thymus in *Podilymbus podiceps* of approximately the following ages: 4½, 5, 6, 6½, 7, 7½, 8 and 8½ days.

The embryonic thymus in this species of grebe is derived from two separate anlagen the third gill-cleft and the fourth inner and outer gill-pouches. The first anlage arises as a pouch-like outgrowth of the third gill-cleft and the second as a similar outgrowth of the fourth endodermal pouch, to the lateral wall of which elements are added from the fourth ectodermal pouch. Through cell proliferation these pouch-like structures become solid bodies, at the same time becoming separated from the germ layers and finally becoming united, on each side, into a single body, the embryonic thymus. The union or fusion into a single body on each side appears to be largely due to two causes. In the first place, the anlagen become straightened so as to come to lie parallel with the long axis of the neck, which tends to bring them together. In the second place, the medianward shifting of the jugular vein crowds the second anlage over against the first so that the anterior end of the second overlaps the posterior end of the first.

The thymus anlage furnished by the third gill-cleft is larger than that arising from the fourth gill-pouches, and the part played in its formation by the ectoderm is also greater in the former than in the latter.

Four well-defined ectodermal and endodermal gill-pouches are present in embryos about four and one half days old. There is also present a postbranchial body, or structure corresponding to a fifth endodermal pocket, as an evagination of the posterior wall of the fourth inner gill-pouch where this opens into the pharynx. Later on this postbranchial body becomes constricted off and disappears rather rapidly.

On the left side a portion of the third gill-cleft lying between the pharynx and the anlage of the thymus becomes converted into an epithelial body. For a period of about three days this body is continuous

with the pharyngeal wall, on one hand and with the pouch-like anlage of the thymus, on the other. Both connections are then lost and the body disappears before the end of the seventh day. This epithelial body has not been observed on the right side in any of the series studied.

In connection with the second gill-cleft a cell-thickening in every way similar to the thymus anlage of the third gill-cleft is formed simultaneously with the latter, but it begins to degenerate about the sixth day and takes no part in the formation of the thymus.

The Chromosomes in the Gryllidæ: W. J. BAUMGARTNER, University of Kansas.

In a former paper the writer showed that the shape assumed by the chromosomes of *Gryllus domesticus* during the prophase and metaphase of the first spermatocyte division was constant and could be used as a differential characteristic. The spermatocyte has 11 chromosomes.

The examination of nine other species of this family shows a great variation in shape, size and numbers of chromosomes. The highest number is 29 spermatogonic elements and the lowest 13. The accessory in all the species studied exhibits the same peculiarities of shape and behavior as described for *G. domesticus*.

Three species have 23 chromosomes agreeing with the Acrididæ as described by McClung and others.

In several species certain chromosomes can be readily recognized by their shape and size. The tree crickets have 19 spermatogonic chromosomes, of which the accessory and four others are very long. In the prophase the four long ones unite into two enormous rings. If these rings are multiples, *i. e.*, quadruple, as one might easily conclude, then the number of elements in the two species examined is really 23.

Apitlus agitabor has 7 spermatocytic chromosomes. Of these one is the accessory, one is ordinary in size and simple in shape, and the other five are large rings. Should these last prove to be quadruple then the real unreduced number here is also 23.

Nemobius fasciatus has 8 chromosomes in the first spermatocyte, of which 4 are much larger and ring-shaped. Quadrupling these gives a real number of 23. But *Nemobius exigeus* has nine elements, of which also 4 are large rings. Quadrupling these and doubling all but the accessory, we get 25. The number of elements in two other species can not be reduced to 23 by any marked size and shape differences.

Our result shows the three species have 23 chromosomes. Four species can be reduced to 23 by using the "multiple chromosome" idea and three species can not.

The Gryllidæ also have much greater difference in shape and size of chromosome than the Acrididæ. The difference of shape has a marked tendency to be constant.

Was the Hydroid or the Medusa the Original Form of Hydromedusæ? C. C. NUTTING, University of Iowa.

The development of typical forms of Hydromedusæ was briefly described and the alternation of generation discussed.

The elimination of successive terms in the life histories was described and the various methods of reproduction presented, showing the two lines of divergence to the medusa-form, on the one hand, and the hydroid form, on the other; ending in the free medusa without fixed hydranth and the fixed hydranth without medusæ, respectively.

The argument of ontogeny as showing the phylogeny of the group points to the

hydranth as the more primitive form. The homology of hydranth and medusa.

The argument based on radial symmetry points toward the same conclusion.

The Cause of Dominance in Heredity and Experimental Production of Variability in Dominance: W. L. Tower, University of Chicago.

An Important Period in the History of the Sex Cells of Rana pipiens: Bennett M. Allen, University of Wisconsin.

The Experimental Production of Germinal Variations, Methods, Precautions and Theory of their Causation: W. L. Tower, University of Chicago.

Exuviation, Autotomy and Regeneration in Ceratium: C. A. Kofoid, University of California.

The cellulose exoskeleton or theca of the dinoflagellates by virtue of its form resistance, specific surface and specific gravity is an important organ of flotation. Prolongation of the three horns and surface differentiations in the form of lists, fins, ribs and rugosities increase the specific surface and thus facilitate flotation. Walls thickened by age or by compensatory regeneration cut off access of light to the chloroplasts and also increase the specific gravity. Low temperatures increase the molecular friction of water and thus increase its buoyant properties. Changes in vertical location of these pelagic protozoa or modifications in the temperature of the circumambient medium thus demand an adjustment of this organ of flotation to the changed conditions of environment.

In many dinoflagellates the exoskeleton is shed periodically *in toto* by ecdysis either with or without schizogony. In *Ceratium,* at least in the marine species, ecdysis is unknown. In schizogony of *Ceratium* the theca is parted diagonally along definite suture lines between the plates and each daughter cell regenerates the missing half, maintaining the ancestral facies throughout by compensatory regeneration. Long-continued schizogony gives rise to individuals of senile aspect with heavy rugose exoskeleton. Examination of San Diego plankton has brought to light evidence of the fact that heavily armored *Ceratium* in warm surface waters drop off this exoskeleton by exuviation, piecemeal, plate by plate, and regenerate a new wall of more delicate texture.

In deeper levels or in plankton at San Diego of semitropical facies autotomy of the horns is frequent. This autotomy may occur at any level of the horns from the tip to the base. It occurs in both antapical horns coincidently and may also appear in the median apical horn. It is regulatory in character, for the specific type of balanced relationship of the antapicals is approximately preserved. Autotomy is an adaptation to flotation at deeper levels or in higher latitudes.

Regeneration of the horns after autotomy and also renewed growth of the horns without autotomy result in an increase in specific surface and are adaptations to flotation in higher levels or lower latitudes. This regeneration is usually terminal, but is sometimes basal in location on the horns. It is also regulatory in character, preserving the balanced relation of symmetry or asymmetry of the horns which is characteristic of the species.

Muscle Attachment to the Body Wall in the Nymphs of Anax: W. A. Riley, Cornell University.

The alary muscles of the nymph of this dragon-fly are exceptionally favorable for the study of the relation of the muscles to the body wall. The hypodermal cells at the point of attachment of the muscles are very much elongated (about $50\,\mu \times 5\,\mu$), and in specimens fixed in alcohol and

stained in Delafield's hematoxylin there is every indication that the attachment is through the intermediary of these cells. However, in thin sections (2 μ–3 μ) fixed in Flemming's fluid and stained in iron hematoxylin it is seen that the muscle fibrillæ pass through the cells and thus attach directly to the cuticle. Study of developing muscle indicates that, in Snethlage reports for *Artemia,* the cells are epithelial muscle cells which give rise to the chitin, on the one hand, and to the muscle as well.

The Skeletal Parts of the Sand-dollar: EMILY RAY GREGORY, Wells College.

The test of the sand-dollar follows the structure typical for echinoderms, but has some interesting modifications. The apical region is occupied by a single plate which functions as the madreporite. The minute pores are irregularly arranged and increase in number as the animal grows. There are genital pores at the junction of the central plate and the first pairs of interradials 1–4, but the pore is wanting in the interradial area 5. Ocular pores occur between the central plate and the first pairs of ambulacral plates. The anus is found on the ambitus between the rows of interradial area 5. Oral plates are wanting and there are only minute calcareous granules in the membranous peristome. The ring of plates nearest the mouth consists of ten (paired) ambulacral plates, and five, therefore unpaired, interambulacrals. Some authors appear to refer to this now as the peristome. The coronal portion of the test with its peculiar petal areas is familiar. The line of the ambitus does not correspond to the sutures between the plates. The perignathic girdle is reduced to an inconspicuous ridge, but on the unpaired interradials there are wedge-shaped apophyses to support the lantern. The number of plates on the oral surface is established by the time the test is 7 mm. in diameter; after this these plates increase in size but not in number. The number of plates on the aboral surface increases until the diameter of the test is 46 mm. After that a few more plates may be added to the petal area as the last interambulacrals increase in size. Increase in the number of plates occurs only at the edge of the central plate and is, of course, greatest in the ambulacral area. There may be seven or even nine plates in the petal to one interradial. All the plates of the ambulacral system are primary; no such secondary and tertiary plates are found here as are seen in *Echinus* (Chadwick). The pores in the petal area are all between the plates. Elsewhere they may pass through the plates. The unpaired pores increase in number from the petal to the edge in wedge-shaped areas which meet, and there is a dense ring of them about the ambitus where there may be three or four rows of pores through a single plate.

The inner surface of the skeleton shows remarkable structures. The distal half or third is almost covered with pillars and ridges which grow from both surfaces and fuse, leaving small irregular spaces between. The spines in cross-section are star-shaped, with four to thirteen points. Longitudinally they show a fenestrated structure. Six forms are to be distinguished in different areas.

A Study of Colorado Entomostraca: GIDEON S. DODDS, University of Colorado.

Up to 1902 but 10 species of *Entomostraca* were listed from Colorado. That year Beardsley published a list which included 24 species new to the state. His collections were from the plains region. In 1904 Professor Henry B. Ward added 8 species from alpine lakes in the Pikes Peak region, and in 1907 Chancey Juday listed 10 more from Twin Lakes. Three others

are listed by Marsh in the same year. These 55 species are, so far as the writer can learn, all that are known for the state.

Collections have been made by the author from a number of lakes on the eastern slope of the Rocky Mountains. These lakes comprise a pretty complete series, from plains lakes at an altitude of about 5,000 feet, to lakes at 11,500 feet which are never free from snow and ice. The alpine *Entomostraca* and the factors governing their distribution are being studied. Collections show that there is a rich Entomostracan fauna, except in the very highest lakes, where all animal life is scarce. The writer has thus far determined 14 species, three of which are new to the state.

The Relation between Habitat and the Taxonomic Characters of Gryllus: Frank E. Lutz, Carnegie Station for Experimental Evolution, Cold Spring Harbor, N. Y.

Size of taxonomic characters is a function of the factors of the environment.

Sociology applied to Pigeons: Wallace Craig, State Normal School, Valley City, North Dakota.

Zoology and psychology have long labored to explain the elaborate singing and cooing, dancing and strutting, and other such performances of birds. The results have been most unsatisfactory—zoology and psychology are not sufficient to explain such behavior, for it needs sociologic treatment.

An intimate acquaintance with pigeons impresses one with the fact that their cooing and strutting performances are a kind of ceremony. Just as the primitive man must perform a certain ceremony upon every important occasion in his life, so the pigeon must give a certain call or coo, and must go through a bowing or strutting performance upon all important occasions; as, when he awakes in the morning, when he goes to roost at night, when he joins the flock, when he meets another male to fight, when he meets a female to court, etc.

The utility of these pigeon performances is the same as that of ceremony in primitive man—social control. There is a prevalent notion that animals which form societies, especially the ants, bees and wasps, are so mechanically bound together as to be free from that conflict between individuality and sociality which is so marked in human life. This notion is erroneous: it is probably erroneous even with regard to ants, bees and wasps; it is certainly erroneous if applied to pigeons; the pigeon is a true free individual, hence social ends among pigeons can be secured only by some means of social control. The social life of pigeons is chiefly family life of a highly complex and specialized nature: the numerous details of this family life are regulated by social control; the actions of the different individuals in the family are connected and socialized through control by ceremonial observances.

Occurrence of the Cysticercus of Tænia solium in Sheep: B. H. Ransom, U. S. Department of Agriculture.

A number of cases of the occurrence of cysticerci in the muscles of sheep have been reported by various authors. In most cases the data given are not sufficient to show definitely whether the cysticerci in question belong to *Tænia solium,* the armed tapeworm of man, as some authors have believed, or whether they belong to *Tænia hydatigena,* the marginate tapeworm of the dog, as maintained by other authors. Bongert (1899), however, has described a cysticercus found in the muscles of a sheep, which is evidently the cysticercus of *Tænia solium,* and that the sheep may act as the intermediate host of this tapeworm of man seems therefore to be pretty well established.

Dr. L. E. Day, in charge of the branch pathological laboratory of the Bureau of Animal Industry at Chicago, recently sent into the Zoological Laboratory of this bureau specimens of the muscles of a sheep extensively infested with small cysticerci. These cysticerci when removed from the capsule surrounding them measure 2 to 3 mm. in diameter and are slightly oval in shape. The head process projects into the bladder from one side, as is the case in the cysticercus of *Tænia solium*. In the cysticercus of *Tænia hydatigena* the head process is invaginated from one end of the bladder instead of from the side. Possibly, however, the position of the head depends upon the location of the parasite rather than upon specific peculiarities. Accordingly, it might happen that the head process would develop from the side of the cysticercus of *Tænia hydatigena* instead of the end if the parasite were located in muscle tissue, and the fact that in the mutton cysticerci found by Dr. Day the position of the head process is different from that in the cysticerci of *Tænia hydatigena* when located in relation with the serous cavities of the host, the usual location, can not be considered absolute proof that the mutton cysticerci in question do not belong to *Tænia hydatigena*. The hooks of these cysticerci number from 24 to 32 in different specimens. The large hooks measure 135 to 160 μ in length, and the small hooks 100 to 120 μ. The roots of the hooks are only slightly developed, and the hooks, therefore, do not present all of the characters to be found in fully grown hooks, so that on the basis of the hooks alone it would be difficult to determine whether these cysticerci belong to *Tænia solium* or to *Tænia hydatigena*. Since, however, they possess a prominent characteristic of *Tænia solium* which is not shared by *Tænia hydatigena*, that is, the outer surface of the bladder is marked with numerous small tubercle-like projections, and since also, in other particulars of structure as well as in location (in the muscles) they agree more closely with the former than with the latter species, they have been identified as *Tænia solium*.

Further Results of Heterotransplantations of Blood-vessels: C. C. GUTHRIE, Washington University.

Continuity of divided carotid arteries in dogs was reestablished by interposing segments of blood-vessels from cat and rabbit. Good function was observed after more than eight months.

On the Ovary and Ova of the Cuban Cave-fishes: HENRY H. LANE, University of Oklahoma.

The viviparous blind-fishes (*Lucifuga* and *Stygicola*, family Brotulidæ) living in the subterranean streams of Cuba have a Y-shaped ovary which consists of a mass of stroma containing numerous sinuses filled with lymph and adipose tissue, and the whole covered with an epithelium continuous with that lining the surrounding ovisac. This epithelium is quite unique in that it frequently contains numerous blood-capillaries. The ova arise in "nests" or masses of several hundred each, deep within the substance of the stroma and in the adult ovaries have at that time an average diameter of about ten micra. Only one ovum from such a nest usually develops to maturity, the other ova of the nest undergoing a rapid degeneration and being ultimately absorbed into the substance of the growing ovum. In many instances whole nests fail to mature a single ovum, in which case all the ova of such nests undergo a slow, pigmented degeneration *in situ*. This destruction of so many ova at an early stage is an adaptation to the viviparous habit of these fishes. The whole ovary as just described is enclosed within a Y-shaped ovisac which is continued to the urogenital pore as the oviduct. The young

fishes, which are but few in number, only two to ten in any case as yet observed, are not developed in separate sacs, but lie within the lumen of the ovisac, gradually compressing the ovarian stroma as they develop. They attain a length of 20 to 25 millimeters before birth, while the adults may be as much as 100 millimeters long. Viviparity is apparently a comparatively recent acquirement of these fishes, though probably attained before they left the deep-sea for the fresh-water cave streams.

Notes on Diplosis sorghicola Coq.: Carleton R. Ball, U. S. Department of Agriculture.

The frequent failure of sorghums to produce seeds in our southern states has long been noted. Many theories regarding the cause have been advanced: fungi, insects and unfavorable meteorological conditions, such as excessive precipitation, high humidity. Severe drouth or hot winds are the causal agencies most commonly assigned. Among the growers this trouble is known as "blast" and is usually held to be caused by excessive rainfall and the consequent washing away of pollen during the blooming period. Experiments made during the past season proved conclusively that the injury results from the attacks of a small fly, which has been identified as *Diplosis sorghicola* Coq., for which the name sorghum midge is here proposed. The eggs are laid within the spikelet and the larva absorbs the juices of the ovary through its body walls, causing the death of the ovary and sterility of the infested heads. The insect is prolific; the life cycle is short; and the crop is totally destroyed in badly infested areas. Two parasites are known. Relief may also be found through breeding immune varieties.

Mechanics of Orientation in Lower Organisms: S. O. Mast, Johns Hopkins University.

Orientation in lower organisms stimulated by light may be classified as direct and indirect. In direct orientation the organism turns directly toward or away from the source of stimulation, *e. g., Volvox, Arenicola* larvæ, etc.

In indirect orientation the organism makes preliminary random movements, which bear no definite relation to the apparent point of stimulation, until it reaches a position in which the stimulation is reduced to a minimum. This position it retains in moving forward and thus becomes oriented.

The random movements resulting in orientation may be restricted to motion toward a structurally defined side, as in *Euglena, Stentor,* etc.; or they may not be thus restricted, as in some of the worms.

A detailed study of the structure and light reactions of *Euglena,* which orients indirectly, and *Volvox* and *Arenicola* larvæ which orient directly, shows that the reactions of these three forms, apparently so different, are fundamentally the same. There does, however, not appear to be any definite relation between the reactions of organisms which orient by means of unrestricted preliminary random movements and the reactions of those in which the random movements are restricted to motion toward a structurally defined surface.

No theory of reaction yet formulated covers all cases. The theory of Sachs, formulated for light reactions in plants and accepted by Loeb, who applied it to animals, is not in accord with the observed reactions in any of the organisms studied.

On some Isopods of the Family Dajidæ from the Northwest Pacific Ocean, with Descriptions of a New Species and a New Genus: Harriet Richardson, Smithsonian Institution.

During the cruise of the U. S. Bureau of Fisheries Steamer *Albatross* to the

Northwest Pacific Ocean, some new Dajidæ were collected, one being the type of a new genus, *Arthrophryxus*, and the other the type of a new species of *Holophryxus, H. giardi.* An immature stage of *Holophryxus giardi* was also obtained and is of interest in being a stage not heretofore recorded in the development of the female from the cryptoniscian larva to the adult form. Both of these parasites are attached to the dorsal side of the carapace of the host with the head directed posteriorly. The male *Holophryxus alascensis* Richardson is also described for the first time from a specimen obtained at Monterey Bay.

Leidya distorta (Leidy) Found on a New Host: HARRIET RICHARDSON, Smithsonian Institution.

Specimens of *Leidya distorta* (Leidy) found in the branchial cavity of *Pachygrapsus transversus* Gibbes, from the Bermudas, were recently sent me by Professor A. E. Verrill. This species has been recorded as found in the branchial cavity of *Uca pugilator.* The fact that this parasite has been found on a new host gives evidence that this genus and species is not confined to one genus and species of host. As no descriptions or figures of this form have been given since those published by Leidy, the parasite is again described and figured, as well as the young female, which is described and figured for the first time.

The following demonstrations were exhibited:

L. B. Walton: (1) The ideal dissecting tray; (2) early stages of *Eurypauropus spinosus* Ryder; (3) museum cataloguing; accession and department catalogue cards.

Henry F. Nachtrieb: (1) Early stages in the development of the thymus of the pied-billed grebe—reconstruction of one stage; (2) the sensory ridges of the lateral line and the primitive pores of *Polyodon spathula.*

R. M. Strong: A litter of short-tailed and tailless puppies.

Thomas G. Lee: Early stages in the development of *Dipodomys* and other rodents.

F. R. Lillie: Karyokinetic figures of centrifuged eggs.

S. O. Mast: An electric thermo-regulator.

Charles Brookover: Ganglion cells on Pinkus's nerve of *Amia* and *Lepidosteus.*

R. S. Sheldon: Medullated nerve fibers in the olfactory mucous membrane of fishes.

W. L. Tower: (1) Demonstration case to illustrate the evolution of the *lineata* group of the genus *Leptinotarsa,* showing forms that have been produced in experiment and sports occurring in nature; (2) demonstration case to illustrate the results obtained in the production of sports experimentally—arranged to show the results produced in the stimulated germ-cells and the results from those not stimulated in the case of the same parent; (3) demonstration case to show the results obtained in the transplantation of *Leptinotarsas* from one habitat into another and the proof that they are different in the new habitat as demonstrated by the behavior of the modified and unmodified form when crossed with a third species; (4) demonstration cases to illustrate results obtained in the study of variability of dominance in crossing.

C. R. Bardeen: Abnormal toad and frog larvæ from eggs fertilized by spermatozoa exposed to the Roentgen rays.

W. J. Baumgartner: A cheap sharp microtome knife.

Section F of the American Association for the Advancement of Science was organized at the Chicago meeting with the following officers:

Vice-president and Chairman of the Section—E. B. Wilson, Columbia University.

Secretary—C. Judson Herrick, University of Chicago.

Member of the Council—C. H. Eigenmann, Indiana University.

Member of the General Committee—G. E. Coghill, Denison University.

Sectional Committee—E. B. Wilson, vice-president, 1908; E. G. Conklin, vice-president, 1907; C. Judson Herrick, secretary; Frank Smith, one year; W. E. Ritter, two years; A. W. Bleile, three years; A. L. Treadwell, four years; C. C. Nutting, five years.

At the business session of the Central Branch of Zoologists the following officers were elected:

President—E. A. Birge, University of Wisconsin.

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

Secretary-Treasurer—H. H. Newman, University of Michigan.

Member of the Executive Committee for Three Years—C. M. Child, University of Chicago.

The following were elected to membership in the Central Branch: Oscar Riddle, V. E. Shelford, W. S. Miller, A. W. Meyer, James A. Nelson, C. J. Herrick.

Thomas G. Lee,
Secretary

University of Minnesota

SCIENTIFIC BOOKS

A First Course in the Differential and Integral Calculus. By William F. Osgood, Professor of Mathematics in Harvard University. Pp. xv + 423. New York, The Macmillan Company. 1907.

First Course in Calculus. By E. J. Townsend, Professor of Mathematics in the University of Illinois, and G. A. Goodenough, Associate Professor of Mechanical Engineering in the University of Illinois. Pp. x + 466. New York, Henry Holt and Company. 1908.

A Course in Mathematics for Students of Engineering and Applied Science. By Frederick S. Woods and Frederick H. Bailey, Professors of Mathematics in the Massachusetts Institute of Technology. Vol. I. Pp. xii + 385. Boston, Ginn and Company. 1907.

Graphic Algebra. By Arthur Schultze, Assistant Professor of Mathematics, New York University, and Head of the Department of Mathematics, High School of Commerce, New York. Pp. viii + 93. New York, The Macmillan Company. 1908.

A Treatise on the Integral Calculus founded on the Method of Rates. By William Woolsey Johnson, Professor of Mathematics at the United States Naval Academy, Annapolis, Maryland. Pp. v + 440. New York, John Wiley and Sons. 1907.

People who have to do with mathematics fall temperamentally into three classes. There are the theorists. These are interested in doctrines as doctrines. They find their joy in the construction and the understanding of them, and have but little personal interest in applications and utilities, or none at all. The theorist is a lover of logic, of the abstract and the recondite, of pure creations of the intellect. For him a mathematical doctrine is a work of art, of art that is supersensuous, and a theory is valuable in proportion as it is beautiful. In sharpest contrast with the theorists stand the practicians. These despise theory as such, sometimes denying the fact, sometimes admitting it and occasionally avowing it even boastfully. They look upon mathematics as a mere tool, as a spade or a wheelbarrow. The practician is not a man of science, strictly speaking, and he is not an artist. He is an artisan, not an artisan of high type, indeed, nor yet entirely useless. He is allied to the theorist very much as the splitter of rails or the painter of a barn is allied to a sculptor, a creative musician or a master of color and design. The theorist and the practician are organically antagonistic in temperament. The former comprehends the latter as the greater includes the less. The theorist contemns mere practise and avoids it, but he does so deliberately from a knowledge of values and relative worths. The practician hates theory and avoids it, but he does so from necessity, by the "virtue of impotence." The differences between them, be-