tained above. Nor has the year seen any notable advances in our philosophical knowledge of the ganoids. Their fin structure alone has been considered critically,[8] and in this discussion the evolution of the "effective fins" shows the relations of ganoids and teleosts.

Nor has the great group of Teleosts yielded far-reaching results during the past year. The paper of Woodward above cited recapitulates the teleostean fins and skeleton from the standpoint of evolutional philosophy. And, in a matter of detail, Hussakof has described a form of surgeon fish which serves to connect the balistids with the teuthids. On the purely systematic side work has been active, but this phase of research our time will not permit us to treat.

Finally, as to the evolutional philosophy which the study of fossil fishes has touched upon, we can only say that orthogenesis keeps presenting itself with significant persistency. There has, however, been no attempt up to the present time to collect these results systematically —and herein lies a harvest for the reflective worker. We should, on the other hand, mention the vast materials unearthed by Jaekel at Wildungen, for in them he maintains, rightly or wrongly, the appearance of an "explosive" or mutational origin of species.

BASHFORD DEAN

[8] A. S. Woodward, *op. cit.*, pp. 276–278.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
SECTION G—BOTANY

SECTION G of the American Association for the Advancement of Science met during the past convocation week at Chicago, all of the sessions, except the vice-presidential address by Dr. D. T. MacDougal, being held in the Botany Building of the University of Chicago. Three sessions were held for the reading of papers, and all meetings were held in conjunction with the Botanical Society of America, so that in no case were two botanical meetings held simultaneously. The attendance varied from one hundred to one hundred and fifty, and over one hundred professional botanists from outside Chicago were present at the meetings. The sessions were presided over by the vice-president of the section, Professor Charles E. Bessey; in the absence of the secretary, Professor Francis E. Lloyd, Dr. Henry C. Cowles acted as secretary *pro tem.*

The following officers were chosen:

Vice-president—Professor H. M. Richards, Columbia University.

Secretary (five years)—Dr. Henry C. Cowles, University of Chicago.

Member of the Council—Dr. F. E. Clements, University of Minnesota.

Member of the Sectional Committee (five years)—Professor R. A. Harper, University of Wisconsin; (one year, vice Professor Charles E. Bessey, resigned)—Dr. J. M. Greenman, Field Museum of Natural History, Chicago.

Member of the General Committee—Professor M. B. Thomas, Wabash College.

The following resolutions were adopted, in memory of Professor Lucien M. Underwood:

WHEREAS: By the lamented death of Dr. Lucien Marcus Underwood, late professor of botany in Columbia University, science has suffered a severe loss and the American Association for the Advancement of Science, particularly the Botanical Section, an active and esteemed member, be it

Resolved, That this society place on record its recognition of his fruitful labors along his chosen lines in the field of scientific research and instruction and its keen appreciation of the stimulating influence of his personal character and scholarly attainments.

The vice-presidential address of Dr. D. T. MacDougal has been published in full in SCIENCE. Abstracts of the technical papers presented follow:

The Past Season's Experiments with Anthracnose-resistant Clover: S. M. Bain and S. H. Essary. (Read by title.)

Some New Cases of Mendelian Inheritance: George H. Shull.

The common garden sunflower exists in two forms with respect to branching. One of these has a single large head borne on an unbranched stem, the other has a number of strong branches which ascend strongly till they reach nearly the same height as the central axis. The branching is shown to be a Mendelian character, dominating completely over the simple-stemmed type. The garden sunflower differs from the wild *Helianthus annuus* in the color of the disk, the former having a yellow disk, the latter a deep purple disk. The disk color likewise constitutes a Mendelian pair with the purple disk dominating the yellow.

In *Lychnis dioica,* purple and white flowers are shown by a large series of crosses to be a Mendelian pair with purple dominant over white. A large number of families of the composition $DR \times R$ showed a range of variation in the number of purple-flowered offspring from 30 per cent. to 65 per cent. in the different families, and when these percentages were seriated they presented a nearly normal variation curve, showing that the assumption that the unlike gametes unite according to the laws of chance is correct. The usual statement that 50 per cent. purple is to be expected in such cases is inaccurate, for according to the law of chance the 50 per cent. ratio can be properly expected only when the number of observations is infinite. When a normal curve is formed with the mean approximating 50 per cent. within the limits of probable error every proper expectation has been fulfilled.

Both *Helianthus annuus* and *Lychnis dioica* are incapable of self-fertilization, and the occurrence of these cases of typical Mendelian inheritance shows that self-fertilization bears no relation to this type of inheritance, though it was first discovered in a self-fertilizing species.

In *Verbascum blattaria,* two forms occur, one with bright yellow flowers, the other with pale, cream-colored flowers, almost white. These forms constitute a Mendelian pair with the yellow dominant over the pale-flowered form. This differs from the behavior of yellow flower color in *Matthiola* (stocks) and *Polemonium,* in which the white has been shown by Bateson and Correns to be dominant over yellow. The yellow of *Verbascum* proves to be a sap color, while that of *Matthiola* and probably that of *Polemonium* also are a plastid color thus showing that Bateson's classification of the color of *Matthiola* on this basis is probably fundamentally correct.

The Prairie Grass Formation of Southeastern South Dakota: Leroy H. Harvey.

The formation is a part of the Ponca Prairie District of Pound and Clements. Its composition is transitional between the mesophytic eastern and xerophytic western prairies. These two groups of elements during post-glacial migration entered from two distinct centers of migration; the former from the southeast by the Missouri Valley route and the latter from the southwest. The prairie is preglacial in origin and is descended from the climatic prairie of Tertiary times which arose in response to reduced precipitation caused by the upheaval of the Rockies at the close of the Cretaceous.

The floral activity of the formation at Yankton, South Dakota, may be recorded in the following five aspects: prevernal, April 1 to about April 25—six species; vernal, May 3 to about May 31—twenty-

eight species; estival, June 1 to about July 7—twenty-one species; serotinal, July 7 to about August 7—thirteen species; autumnal, August 7 to about September 21—twenty-two species. The prairie elements show a marked grouping into layers which correspond with the floral aspects. Overtopped by the autumnal, the sublayers are successively those of the serotinal, estival, vernal and prevernal. There is a marked distinction in the chresard of base, slope and crest in the prevernal, which becomes less marked in the subsequent aspects, approaching equality in the autumnal. As a result the floral covering shows a corresponding difference upon base, slope and crest in earlier aspects; the influence of position gradually declines, the floral covering presenting a striking similarity over the entire formation in the autumnal.

New or Noteworthy Peronosporales: GUY W. WILSON.

In the course of a monographic study of the Peronosporales several problems in specific limitations have arisen, some of which have been solved and are discussed. To these notes are added the description of two new species of *Albugo* and notes on the distribution of *Phytophthora thalictri* and *Peronospora floerkeae,* both of which are rare species.

Both *Albugo trianthericæ* and *A. cladothricis* were described from Las Cruces, New Mexico, the former occurring on *Trianthera,* the latter on *Cladothrix.* Both are rather closely related to *A. bliti,* but are distinguishable by conidial characters. The oospore of *A. trianthericæ* is also quite characteristic, while that of *A. cladothricis* is unknown. Of the four other species discussed, *Peronospora cyparissiæ, P. rumicis* and *P. hyoscyami* are to be dropped from the list of American species, the first being a mistaken determination of *P. euphorbiæ,* while the other two represent European species with American cognates. *P. rumicis* becomes *P. polygoni* and *P. hyoscyami* becomes *P. nicotianæ,* a species heretofore reported only from South America. *P. arborescens* must also be added to our flora, having been collected in Colorado on *Argemone,* but erroneously reported under the name of *P. corydalis.*

Notes on Cleistogamy of Grasses: AGNES CHASE.

I. The genus *Triplasis* is found to produce late in the season cleistogamous spikelets in small panicles wholly or partly included in the sheaths; specimens of *T. purpurea* (Walt.) Chapman, collected in October, 1907, show a second form of cleistogene, larger than the others, solitary and sessile at the base of the prophyllum.

II. *Amphicarpon amphicarpon* (Pursh) Nash was collected in October, 1907, with perfect grains in the aerial spikelets as well as in the subterranean cleistogamous ones.

Mutations of Rudbeckia hirta: W. J. BEAL.

Dr. W. J. Beal, of Michigan Agricultural College, during the past five years has selected from many thousands of plants, certain peculiar forms, sports or mutations, flowers of some of which he exhibited:

1. A specimen with wide ray flowers, the head four inches across.

2. A large head of flowers with the base of each ray dark purple.

3. A large head with fourteen ray flowers, each quilled or narrow for one fourth inch at the base.

4. A head in which all the rays were tubular or quilled.

5. A head with rays very light yellow.

6. The rays twisted.

7. A very small head with rays about one fourth inch in length.

8. One with center of head green instead of purple.

Plant Zones of the Mountain Lakes in Northern Colorado: Francis Ramaley and W. W. Robbins.

In the Rocky Mountain region of northern Colorado, the lakes of the subalpine and alpine districts are of the morainal type, while those of the montane zone are chiefly meander lakes. Around these lakes zonation is well developed in cases where there is an accumulation of silt.

In a typical morainal lake studied by the writers, there is a *Carex* zone surrounded by a *Salix-Betula* zone. Among the more prominent plants in the former zone are *Dodecatheon* and *Clementsia* besides various grasses and sedges. Mosses occur here also, chiefly *Polytrichum, Mnium* and *Sphagnum.* In the *Salix-Betula* zone there are such plants as *Elephantella, Pedicularis* and a few orchids. This zone is surrounded by a coniferous forest.

A meander lake at about 9,000 feet altitude, showed four zones: (1) *Carex;* (2) *Salix-Betula;* (3) *Dasiphora;* (4) *Campanula.* Still another meander lake (altitude 8,000 feet) had three zones: (1) *Carex;* (2) *Thermopsis;* (3) *Campanula.* Back of these zones in this particular case there is a belt of grassland before the coniferous forest is reached.

Lakes above timber line show no zonation. In all lakes of the montane and subalpine districts, pond weeds occur and yellow pond lilies in many. There is an entire absence of cattail and bulrush vegetation.

It is worthy of note that in general the pondside plants have come down from higher altitudes and the plants of dry situations have come up from lower altitudes. In other words, the mountain mesophytes are largely boreal forms while the xerophytes show austral affinities.

Rock-ridge Vegetation of Northern Colorado: Francis Ramaley and W. W. Robbins.

The sedimentary rock ridges in northern Colorado have a striking appearance due to the considerable dip of the strata and the numerous faults and folds. Sharp escarpments, deep gulches and irregular erosion lines make the country rough and rugged.

A remarkable scrub formation of mountain mahogany (*Cercocarpus parvifolius*) occurs on these ridges, being generally quite dense where there is little soil and frequently stopping as an abrupt line near the foot of a hill or ridge.

At the line of contact between the granites and the conglomerates there is usually a broad lateral valley with rather fine-grained compact soil. This supports a grassland formation with no trees or shrubs. The granite hills to the west have a scattered covering of pines, various shrubs, grasses and perennial herbs. East of the lateral valley are the sedimentary rock ridges with their dense scrub of mountain mahogany and a few scattered pines. In the deep gulches, Douglas spruces and deciduous mesophytic shrubs occur just as in the canyons of the granite foothills.

The rock ridges with much lime in their composition show a very open formation of *Cercocarpus,* the shrubs being often eight or ten feet apart, but on the sandstone the plants make a close stand very difficult to climb through. *Cercocarpus* grows only on a dry, rocky substratum and is replaced by grassland where there is more soil and moisture, while its place is taken by mesophytic shrubs, trees and grasses in moist shaded situations where there is an accumulation of humus.

A careful study was made of one square mile of territory at the contact of the granites and sedimentaries. This territory was mapped and the vegetation charted

so that the more striking differences between granite hills, lateral valley and rock ridges could be seen.

A Preliminary Account of Studies in the Variability of a Unit Character in Œnothera: R. R. GATES.

The most striking character distinguishing the mutant *O. rubrinervis* from its parent *O. Lamarckiana,* is the conspicuous red color present on the petioles and mid veins of the leaves and on the sepals and young fruits of the former. The variability of this red color pattern in the sepals of *O. rubrinervis* has been the main object of study. Painted types of individual buds were used as standards of classes in cataloguing the variability. The variation in the extent of the red on the sepals is definite, forming a reduction series, the color receding from the margin of the sepals and in extreme reduction appearing only as a series of spots along the sides of the median ridge of each sepal, or rarely being wholly absent. By examination of all the flowers of a plant, the mode of the individual may be obtained, and this is found to vary in different individuals. One extreme variant in a culture of 1,000 *O. rubrinervis* plants showed a great increase of the red pigment, which covered not only the whole sepal (including the median ridge, which is otherwise always green) but also the hypanthium. Whether this extreme form will breed true, and how it will behave in a cross, is to be determined later.

The buds of *Œnothera Lamarckiana,* when attacked by a certain insect, produce red pigment as in *O. rubrinervis,* showing that the capacity for pigment production under certain circumstances is present in *O. Lamarckiana* and not that it is confined to certain germ cells only in which it originates suddenly as a new or additional unit character. These and other facts of variation are not in accord with the DeVriesian conception of unit characters in mutation, but may be better explained on another basis.

In all, 1,460 buds from 104 individuals were examined in this preliminary study. A more extensive study of color variations in *Œnothera* is to be made.

Mine Fungi: PERLEY SPAULDING. (Read by title.)

The Loco Investigation: C. DWIGHT MARSH. (Publication reserved.)

Crystal Formation in Cultures of Penicillium: ARTHUR W. DOX. (Presented by Charles Thom.)

In cultures of different species of *Penicillium* upon Cohn's medium, the formation of peculiar crystals was noticed. Crystals were formed only by those organisms which gradually changed the reaction of the medium from acid to alkaline. Chemical analysis showed them to be magnesium ammonium phosphate with six molecules of water. This substance has heretofore been obtained only by precipitation and in microscopic crystals, whereas the crystals formed in Cohn's solution were often two centimeters in length. The finest crystals were obtained when the culture was carefully maintained at a uniform temperature. This work suggests a possible application of mold cultures to the formation of other substances in crystals, particularly those substances that are soluble in acid but insoluble in neutral solutions.

Embryo-sac Development and Embryology of Symplocarpus fœtidus: C. O. ROSENDAHL.

The inflorescences of *Symplocarpus fœtidus* are borne as lateral branches in the axils of the leaves on the upright, monopodial rhizome. They develop very slowly and the rudiments of the flowers are

distinguishable eighteen to twenty months before the time of blossoming. The ovules are formed during the late summer and fall months of the year previous to blossoming. In nearly all cases the ovary is one-chambered, with but one ovule in each chamber. This is orthotropous and pendant from the upper part of the cavity. Occasionally two chambers are found with one or more ovules in each.

A single archesporial cell is differentiated, which becomes the spore-mother cell. This, by two successive divisions, gives rise to four megaspores. In most cases the two megaspores toward the chalaza end lie in the long axis of the ovule, while the two toward the micropylar end lie transversely. All four spores germinate, the innermost one giving rise to the embryo-sac, the others breaking down.

The first divisions of the oospore are transverse and a row of three to four cells is built up before anticlinal walls appear.

In the development of the endosperm a period of free cell formation is followed by the appearance of cell walls whereby a tissue is built up throughout the embryo-sac. It grows rapidly and soon begins to encroach upon the inner and outer integuments and finally begins to push back into the basal tissue of the ovule.

The antipodal cells give rise to a tissue made up of a considerable number of cells with greatly enlarged nuclei.

The proembryo undergoes rapid changes, at first becoming club-shaped and later on pyriform or ovoid. A short suspensor made up of several rows of cells is formed. Upon one side of the embryo, near the suspensor, a small depression appears which deepens into a groove. On the axial side of this groove the leaves and plumule are differentiated. The axes of the plumule and the radicle form a somewhat acute angle with each other, the one being bent back upon the other.

During the differentiation and development of these structures, the protocorm has completely devoured the endosperm and all traces of the integuments have disappeared. The only ovular tissue left is a small remnant on one side of the naked, nearly spherical embryo.

Regeneration in Root-tips of Vicia and Phaseolus: C. H. Shattuck.

This paper gives the results of the writer's recent experimental work at the University of Chicago. The important points developed by this study are as follows: (1) The lysigenous breaking down of the plerome cells above the point of wounding; (2) the fusion, at certain levels, of young cells from opposite sides of a split root-tip in the region of the pericycle; (3) the disrupting of these tissues at lower levels, thus giving rise to two distinct roots; (4) the complete restoration of the circular form of the root by means of a radial meristem in which the ordinary transverse orientation of the cell plate becomes longitudinal; (5) the encircling of stems by a whorl of new roots when spirally cut through the pericycle; (6) that the root orients itself geotropically, not because the vegetative point has reached a particular stage, but always because of the appearance of statolithic starch and fails to regenerate if this does not appear.

Notes on Gymnosporangium macropus: F. D. Heald.

Gymnosporangium macropus has been considered an annual, but the investigations carried on by the author in Nebraska have shown that two years is required for the "cedar apples" to reach maturity. Young "cedar apples" can be found nearly a month before the rust spots on the apple leaves have matured any

æcidiospores. The unusual prevalence of "cedar apples" in Nebraska is due to the extensive use of the cedar as an ornamental tree and for orchard wind breaks with the planting of varieties of apples especially susceptible to the disease. During the past season, æcidiospores were found in viable condition during July, August, September and until October 22, and it was shown that spores from this period produce no evident infection until the spring of the next year when growth is resumed and the young "cedar apples" become visible.

The Bud-Rot of Carnations: F. D. HEALD.

The bud-rot of carnations is a new disease which has only been prevalent in Nebraska and a number of other states during the past few years. The disease has been proved by the writer to be due to a definite species of fungus, *Sporotrichum anthophilum* Peck, which has associated with it a new species of mite, *Pediculoides dianthophilus* Wolcott, as a constant accompaniment.

The disease affects the buds in various stages of maturity and produces a rotting of the petals and other flower parts, at least the parts enclosed by the calyx, thus interfering with the normal opening of the flower. The disease has therefore been termed the "bud-rot" of the carnation.

A Principle of Elementary Laboratory Teaching for Culture Students: CHARLES H. SHAW.

Biological laboratory teaching in general comes far short of accomplishing the results expected. On the average the student develops relatively little of that interest in the subject and power of observation which are the chief reasons for the existence of such courses.

A teacher is likely to find himself able to stimulate a greater degree of interest and effort in part of the lessons than in others. This fact is of primary importance. Laboratory courses should be made up of those lessons in which the teacher finds himself able to bring the class to its maximum of independent effort, leaving to lecture and demonstration the task of keeping the course logically connected and rounded out.

A sort of corollary to the above seems to be that courses are to be modified in the direction of physiology. To reach the desired end it may in some cases even be necessary to omit certain standard topics of morphology. In all cases the goal must be kept clearly in view and any needful sacrifice made without limitation.

The Influence of the Form of Carbon upon the Morphology of Penicillium Cultures: CHARLES THOM.

Cultures of eleven species of *Penicillium* are presented to illustrate the wide difference in morphology produced by changing the source of carbon in synthetic culture media. For comparison the species are exhibited upon potato-agar, then upon synthetic agar in which carbon is presented: (1) as granulated sugar (sucrose), (2) lactose, (3) glycerine, (4) alcohol, (5) tartaric acid. Repeated cultures have shown that the form of carbon presented produces very marked differences in metabolism, in morphology and in the changes induced by cultures upon the substratum—*i. e.*, formation of pigments, crystals, etc. These cultures emphasize the importance of exact definitions of substrata or culture media in describing saprophytes of this genus.

Plant Succession in Eastern Colorado: H. L. SHANTZ.

Climatic and soil factors of the plant habitat. Plant succession on areas which have been broken and deserted for from one to twenty-two years. Chief stages of the succession. Conditions which hasten

or retard the succession. Succession under natural conditions.

The Influence of Wind upon the Distribution of Plants in Iowa and Adjoining Territory: B. Shimek.

Winds tend to produce xerophytic conditions, and their effect in conjunction with topography and drainage, upon the vegetation of the state of Iowa, is discussed. The possibility of forest (mesophytic), as well as xerophytic areas within the state is explained on this basis.

Some Apple Leaf-spot Fungi: Carl P. Hartley.

The finding of eighteen apple leaf-spot fungi in West Virginia is recorded, the commonest ones being *Coniothyrium pirina, Coryneum foliicolum, Sphæropsis malorum,* and an undetermined species. The two first named were grown artificially. Inoculation work with both the *Coniothyrium* and the *Coryneum* indicated that they were not capable of causing serious leaf disease. Both fungi were found on wood, the former apparently wintering on dead twigs.

On the Occurrence of Pith Spots in the Wood of the Soft Maple: Hermann von Schrenk. (Read by title.)

Observations on Change of Sex in Carica papaya: M. J. Iorns. (Read by title.)

Studies in the Genus Gymnosporangium: Frank D. Kern.

This paper gives a brief statement of the problems encountered by those who began the systematic study of the genus *Gymnosporangium* in this country, with an abstract summary of the published results. The data left by past workers was chaotic and insufficient, but by selecting new diagnostic characters and by studying in detail many specimens from all parts of the United States the difficulties have been overcome. For the purpose of bringing together the data in such a manner as to be of material assistance in the determination of specimens, a key involving the characters of the telia is presented. Notes are given explanatory of changes in nomenclature, extensions of range, etc. It has been found necessary to describe three new forms.

Vernal Aspect of the Chaparral Formation of California: Pehr Olsson-Seffer. (Read by title.)

Periodicity in Spirogyra: W. F. Copeland.

The object of this paper is to mention some results of investigation bearing upon the seasonal or periodic activities of *Spirogyra.* The work was continued for twenty-two months in the laboratory and in the field. Indoor work was in ordinary biological laboratories, where over seven hundred aquaria were used. Outdoor study was limited to forty ponds within a distance of twelve miles. At least thirteen species were kept under observation. The period of maximum abundance corresponded exactly with the period of maximum conjugation. The vegetative filaments disappeared at the same time as the conjugating filaments. When a species was in fruit out of doors, it was also in fruit in the laboratory. Experiments and observations seemed to indicate that *Spirogyra* is not a perennial plant; that its activities are limited to a few weeks, or months at most; and that the vegetative and conjugating activities are conditions resulting not so much from external as from internal environment.

Types of Some Rocky Mountain Willows: Carleton R. Ball. (Read by title.)

Dry Rot of Corn and its Causes: James T. Barrett.

Diseases of ear corn which have been called "dry rot" have been found, upon investigation, to be caused by several species of fungi. The one which has been the most

destructive the past two seasons and to which 85 to 90 per cent. of the rot was due is a species of *Diplodia,* very probably *D. maydis.*

When an early infection takes place this fungus causes a premature ripening and shriveling of the ear, which usually remains in an upright position with tightly clinging and dark-colored husks. Later infections which produce various degrees of rot in the ear may or may not present the symptoms mentioned above; in fact, in many cases the disease is not detected until the husk has been removed. The seasonal infections are started by conidia blown from the old rotten ears and the one- or two-year-old stalks left standing in the field.

A form of disease which is not uncommon this season and due to a species of *Fusarium* is recognized in that it is usually more localized than that caused by *Diplodia* affecting the ears in patches. The fungus produces dense masses of mycelium both on the diseased areas of the corn and in pure culture. Microconidia are usually found in abundance, while macroconidia are rare.

A third form of the rot noticed for the first time this season is very characteristic in that infection, with few exceptions, takes place at the tip of the ear and the mycelium soon develops a deep pink color. The fungus thus far has proven to be sterile. The effect on the corn is much the same as that produced by the later infections of *Diplodia.*

Other forms of rot have been found to be due to other species of *Fusarium,* and one to one or more species of bacilli.

From data collected from fifty or more counties in Illinois in 1906, it is estimated that more than 15,000,000 bushels of corn having a value of $5,400,000 were destroyed by rot.

The Relation of "Conjugation" and "Nuclear Migration" in the Rusts: E. W. OLIVE.

The seemingly conflicting results obtained by Blackman and Christman in their investigations of the sexual phenomena in the *Cæoma* type of rusts are to some extent brought into harmony by certain new and supplementary facts recorded in the present paper.

In the several species of *Cæoma* rusts studied by the writer, fertilization was found to be accomplished, much as Christman maintains, through the absorption of a portion of the walls of two essentially similar gametes. The fusion process may begin, however, through a very small conjugation pore, so that as the one protoplast moves through the narrow opening to fuse with the adjoining gamete, the nucleus may thus sometimes be stretched out or constricted, in this condition presenting an appearance quite similar to that which Blackman has termed "nuclear migration." Such an instance is regarded simply as a case of conjugation between two cells in which the connecting pore is as yet small. The writer observed instances in which a Blackman type of conjugation, as it may be termed, through a narrow pore, occurred side by side with a Christman type of fusion, through a broad pore. The essential feature of the process is therefore regarded as the equal participation of two morphologically equivalent cells to form the binucleated "fusion cell."

But although the conclusions of Christman are thus in greater part confirmed, several observations made in connection with the sexual fusions point to the important conclusion that the two gametes differ somewhat in time of development. The observations on which this conclusion is based are as follows: (1) In the *Cæoma* forms the first hyphæ to push up under the epidermis mass themselves often more or

less regularly upright and parallel and then proceed to cut off sterile cells at their tips. The sterile tips push up against the epidermal cells and soon degenerate. A more or less prolonged period of vegetation appears thus to intervene before the conjugations begin. (2) Generally only one of the two conjugating gametes bears such a sterile tip while the other shows no such differentiation. (3) The gamete which bears the degenerating tip cell often appears to be placed somewhat above the other, thus suggesting that the earlier hyphæ fuse, not among themselves, but with other hyphæ which push up later from below. Such a differentiation in time of development does not involve, in the writer's opinion, a morphological differentiation; the lower gamete is therefore not to be regarded as a "vegetative cell." The sterile cell, according to these views, is not an abortive, functionless trichogyne, as proposed by Blackman's theory, but merely a "buffer cell," a degenerate gametophytic cell, morphologically similar to the functional gametes. This of course leaves the so-called spermatia still unexplained.

The Relationships of the Æcidium-cup Type of Rust: E. W. Olive.

The recent work of Blackman and Christman has solved to a great extent the problems which concern the origin of the diffuse *Cæoma* type of rust. But the more complicated, compacted cup fructification apparently needs further explanation. This is rendered evident by the recent discovery in a number of species of large, irregularly-shaped, multinucleated cells, which appear to arise from the stimulated growth which follows the sexual fusion. Sometimes several such multinucleated cells may be seen at the base of the æcidium cup. In some of these instances they undoubtedly originate as detached buds or branches from a single, central growth; in still other cases, more than one fusion apparently takes place and more than one center of growth thus results. It is quite probable that these large, multinucleated cells may prove to be similar to the archicarps of DeBary, Massee and Richards. The basal cells which form the origin of the rows of æcidiospores arise as the ultimate branches of the multinucleated cells.

The æcidium-cup type of rust is thus derived from a deep-seated, more or less limited, mass of cells; and the peridium arises as an enclosing layer, apparently in consequence of the deep-seated character of the fructification, as well as from its more or less centrifugal growth. The fructifying organs of the diffuse *Cæoma* type are, on the other hand, more or less superficially placed, and no peridium is formed in this instance. Many sexual cell fusions, in most instances probably one for every spore-row, occur in this kind of rust; whereas in the æcidium cup but few sexual fusions apparently take place.

The simpler *Cæoma* type sometimes shows in its course of development a phenomenon which, in my opinion, points to the conditions in which the more complicated æcidium-cup fructification probably had its origin. Following the sexual fusion, the two nuclei thus brought together begin rapidly to divide by conjugate division. Sometimes nuclear division thus goes on more rapidly than cell division; so that as a result several nuclei (as many as six have been observed) come to lie in the one large fusion cell. It is quite conceivable that a still further development of such a multinucleated fusion cell, coupled with the partial suppression of other neighboring cell fusions, especially in the case of a deep-lying *Cæoma,* might give rise to the cup-shaped type of æcidium, with its enveloping peridium. This idea is made the basis of the conclusion that the complicated æcidium-cup fructification might be thus directly derived from certain of the

Cæoma-like rusts, and so to be regarded as the last of the evolutionary series of this group of fungi. While there may be some slight resemblances of the æcidium cup in its development to certain Ascomycetes, the regular occurrence of conjugate nuclei in the rust form, as well as the additional wide differences in the spore mother cells of the two groups of organisms, precludes, in my opinion, the idea of any close relationship between the two, as has been assumed by Blackman.

Are Canned Goods Sterile? T. J. BURRILL.

The canning process depends for its efficiency and safety upon the exclusion of living bacteria; sometimes by defects in the cans or in the process failure occurs. Do cans apparently sound ever contain living bacteria? Several investigators have reported affirmatively, but mistakes are hard to avoid and the reported results can not be considered conclusive.

For this investigation a new method was adopted, believed to be more likely to reach the truth, but in this there are shown to be some growths—eleven out of two thousand six hundred and one cultures or 0.42 per cent. There is every reason to believe these are contaminations in spite of the care taken to prevent them. In one case there were two positive cultures, from one can; otherwise only one tube out of seventeen from a can showed growth.

Conclusion: cans which "keep" are sterile.

HENRY C. COWLES,
Secretary pro tem.
UNIVERSITY OF CHICAGO

THE ENTOMOLOGICAL SOCIETY OF AMERICA

THE third meeting of the Entomological Society of America was held at the University of Chicago, December 30 and 31, 1907, in affiliation with the American Association for the Advancement of Science, and other societies. About one hundred were in attendance, coming from as widely remote localities as Maine and California, Ottawa and Louisiana.

On Monday sessions were held for the reading of papers. On Monday evening the annual address was given before the society by Professor Herbert Osborn, of the Ohio State University, his subject being "The Habits of Insects as a Factor in Classification." The address was followed by a most enjoyable smoker, at which the members of the society and their friends were the guests of the Entomological Section of the Chicago Academy of Sciences.

At the annual business meeting on Tuesday, December 31, the following officers were elected:

President—Dr. William Morton Wheeler.
First Vice-president—Dr. John B. Smith.
Second Vice-president—Rev. Professor C. J. S. Bethune.
Secretary-Treasurer—J. Chester Bradley.
Additional Members of the Executive Committee—Dr. James G. Needham, Professor V. S. Kellogg, Professor Herbert Osborn, Professor J. H. Comstock, Dr. P. P. Calvert, Mr. F. M. Webster.
Standing Committee on Nomenclature—(to serve three years) Dr. H. T. Fernald, (to serve two years) Professor T. D. A. Cockerell, (to serve one year) Dr. E. P. Felt.

Committee on Nomenclature.—Dr. Fernald moved, seconded by Dr. Smith:

1. That the Entomological Society of America hereby endorses the Code of Nomenclature adopted by the International Zoological Congress as the code which should be used by the members of the society so far as it can be applied.

2. That cases not covered by this code which may be presented to the society for consideration, be referred to a standing Committee on Nomenclature, to consist of three members, one member of which shall be elected each year for a term of three years, and the opinion of this committee on cases referred to them, shall be reported to the society at the first annual meeting subsequent to their reference to the committee.

Mr. Bradley moved to amend by striking out the second clause, because entomology should not be treated as distinct from zool-