society had gained several hundred new members this last year and was on a continued upward growth was pleasing to all.

The most important action taken at the meeting was the decision to organize a Division of Industrial Chemists and Chemical Engineers who shall elect their own officers, and to begin the publication of the *Journal of Industrial and Engineering Chemistry* with a board of editors carefully picked as experts in the several lines of chemical industry.

The publication of *Chemical Abstracts*, which is now beginning its second volume, has been a very great benefit to the society and remarks of approval were heard on all sides. It has published this last year 7,975 abstracts, covering 3,047 pages, and abstracting over four hundred journals. Its influence is widely felt in the present prosperity of the society.

It is hoped that by this large union of American chemists the great duplication of effort which has been characteristic of foreign journals will be avoided in America and that the members of the American Chemical Society can be given for a minimum cost literature which will cover almost the entire field of chemistry.

Excursions, banquet, smoker and social functions were largely attended and every member present went home with the determination that he would be at the next meeting.

Charles L. Parsons,
Secretary

THE BOTANICAL SOCIETY OF AMERICA[1]

The second annual meeting of the federated societies (the fourteenth of the Botanical Society of America) was held in Hull Botanical Laboratory, at the University of Chicago, December 31, 1907, to January 3, 1908, under the presidency of Professor G. F. Atkinson. About fifty members were in attendance at the meeting, which was thoroughly interesting throughout. The excellent arrangements made by the members of the local committee and by the staff of the department of botany of the University of Chicago, contributed largely to the success of the meeting.

The officers elected for 1908 were:

President—Professor W. F. Ganong, Smith College.

Vice-president—Dr. C. L. Shear, Bureau of Plant Industry.

Treasurer—Dr. Arthur Hollick, New York Botanical Garden.

Secretary—Professor D. S. Johnson, Johns Hopkins University.

Councilors—Professor W. G. Farlow, Harvard University (one year); Professor J. M. Coulter, University of Chicago (two years), and Professor W. Trelease, Missouri Botanical Garden (three years).

Three associate members were elected to full membership and three botanists were elected to associate membership.

The Committee on the College Entrance Option, Professor W. F. Ganong and F. E. Lloyd, made a report, of which, because of its general interest, an abstract is printed here:

The report outlines the work of the committee from its appointment in December, 1900, to the present. The high school course formulated by the committee, on the basis of the reports of the National Educational Association and after wide consultation with prominent teachers throughout the country, is now used as a basis for its examinations by the College Entrance Examination Board, and is given by a considerable number of preparatory schools. The committee recommended (*a*) that it be enlarged somewhat in numbers and scope, to become a standing committee on education, of three members, having charge of this option and such other educational

[1] A union of the Botanical Society of America, the Society for Plant Morphology and Physiology and the American Mycological Society.

matters as may be referred to it by the society; (*b*) that a fourth edition of its course with appropriate accessory matter be printed at the expense of the society for wide circulation; (*c*) that it be authorized to cooperate with a similar committee of the American Society of Zoologists in formulating a high school course in biology. The committee further recommended (*d*) that all members of the society engaged in college or university work be requested to call the attention of their respective faculties to the fact that college entrance examinations are now being held every June in all the principal centers of the country in a year's thorough course in botany, a course ample to count as one point out of fourteen or fifteen for entrance. It seems desirable for all the interests concerned, the colleges, the schools and the science, that this course should be accepted as an option for entrance by all colleges. The recommendations were all adopted by the society.

The next annual meeting will be held in conjunction with the American Association for the Advancement of Science.

An important feature of the program was the session devoted to a symposium on "Aspects of the Species Question." Six twenty-minute papers were read, by C. E. Bessey, N. L. Britton, J. C. Arthur, D. T. MacDougal, F. E. Clements and H. C. Cowles, and these were followed by an hour's general discussion. These papers will be published soon in SCIENCE. The remaining scientific sessions were devoted to the reading of botanical papers, of which abstracts follow:

The Foot in Bryophytes: Professor C. R. BARNES and Dr. W. J. G. LAND, University of Chicago.

Cell Lineage in Fern Roots: Professor H. S. CONARD, Iowa College, Grinnell, Iowa.

Lateral segments of the initial cell of homosporous leptosporangiates are not divided in the sequence described in German, English and American text-books. On the contrary, the first division is periclinal, and the second and third walls divide the segment into sextants. The fourth wall is periclinal, and lies ultimately between pericycle and endodermis. An attempt was made to determine whether the serial arrangement of rhizogenous cells in cyatheaceous ferns is a trustworthy ordinal character. The series is found to be so much interrupted in *Alsophila australis* as to be of very doubtful taxonomic value.

Report on Dioon and Ceratozamia: Professor C. J. CHAMBERLAIN, University of Chicago.

The life history of *Dioon edule* has been studied and a paper dealing with the ovule and female gametophyte has been published. A second paper, which will be published soon, contains a cytological study of the development of the blepharoplast and sperm, an account of fertilization and a study of the embryogeny of *Dioon edule*. The latter is peculiar and may throw some light upon the origin of the free nuclear condition of gymnosperm embryos.

Dioon spinulosum is more primitive than *D. edule* and may show some Bennettitales characters.

A preliminary survey of *Ceratozamia* shows that the blepharoplast is the largest yet discovered, that there are sometimes more than two sperms, and that the embryo develops very slowly, so that it may be little beyond the free nuclear condition when the cone begins to decay. There is only one cotyledon. As in *Dioon,* the seed does not necessarily pass into the resting condition, but growth may be continuous from fertilization up to the leafy plant.

The field study, which is still very incomplete, shows that there are probably only two species of *Dioon,* the confusion having arisen from the fact that the plants

present strikingly different characters at different stages in the development of the individual.

A Unicellular Marine Brown Alga: Dr. G. T. Moore, Marine Biological Laboratory. (By title.)

The Cytology of the Male Gametophyte of Polytrichum juniperinum: Professor C. E. Allen, University of Wisconsin.

The chromosome number in somatic and spermatogenous cells is six. In vegetative divisions an aggregation of cytoplasmic materials, but no definite body of kinoplasmic or centrosomal nature, appears in the region of the spindle poles.

In the early spermatogenous divisions, a dark-staining plate appears at each pole; fibers connect the two plates, forming a broad-poled spindle. These plates persist during the division.

In later divisions appears a group of bodies similar to the "chromidial filaments" of animal cells. The group divides into two, which separate from one another and pass to the poles of the future spindle.

In one or more of the latest spermatogenous divisions, probably only in the last, a dark-staining granule, surrounded by astral radiations, appears in the cytoplasm near the nucleus. This divides into two granules, which separate and, each with its aster, pass to opposite sides of the cell. A spindle is formed between the two granules, the nuclear membrane disappears, and nuclear and cell division completed. After the formation of the spindle, the polar radiations disappear; the polar granules become less distinct, but are sometimes seen as late as the telophases. Cell division is in all cases by means of a cell-plate.

After the last division, the cell walls are dissolved and the cells round up. Each now contains, besides the nucleus, a long rod (the blepharoplast) lying just inside the plasma membrane, and a large dark-staining body, which becomes constricted into two (bodies *a* and *b*). The nucleus becomes applied closely to the blepharoplast, pushes out a beak toward one end of the latter (the anterior end), and elongates gradually into a slender spiral of about one and one half turns. After the early stages the blepharoplast can not be distinguished, except that its anterior end seems to extend a short distance beyond the nucleus. The two cilia grow out from this portion of the blepharoplast. Body *a* becomes applied closely to the anterior end of the blepharoplast, persisting to a very late stage. It may give rise to a slight swelling at the anterior end of the mature antherozoid. Body *b* becomes attached to the posterior portion of the nucleus and persists, forming the "vesicle" which is for a time attached to the mature antherozoid.

Apogamy in Nephrodium: Dr. S. Yamanouchi, University of Chicago. (By invitation.)

The nuclear condition in *Nephrodium molle* may be summarized as follows:

1. The nuclei of the prothallia contain 64 or 66 chromosomes, the x number, and the nuclei of the gametes contain the same number. The fusion nucleus in the fertilized egg presents 128 or 132 chromosomes, the $2x$ number, which remains unchanged until it is reduced during sporogenesis. Consequently, in the normal life history of *Nephrodium* the gametophyte generation contains the x number of chromosomes and the sporophyte generation the $2x$ number.

2. The nucleus of a prothallial cell with the x number of chromosomes (64 or 66) sometimes become directly the nucleus of a sporophyte, apogamously produced; so that the x number of chromosomes continues through the whole life history of the apogamous sporophyte. This fact does not seem necessarily to affect the fundamental idea that the alternation of generations is marked by the difference in the number of

chromosomes in the normal life history; it is simply an abnormal case of secondary importance. Still it must be admitted that in the case of apogamy, at least, the number of chromosomes is not the only factor which determines the character of the sporophyte and gametophyte.

Further Studies on the Chromosomes of Œnothera: Dr. R. R. GATES, University of Chicago. (By invitation.)

On account of the well-known variation in chromosome numbers in root-tips, it was important that the chromosomes of *O. gigas* should be counted in the germ cells. The pollen mother cells of *O. gigas* have 28 chromosomes, the reduced number being 14. In rare cases one chromosome passes to the wrong pole of the heterotypic spindle, making the numbers in the daughter nuclei 15 and 13.

This mutant is rare, having appeared only four times in all cultures, only two of these four maturing seeds. It is larger in all its parts than the parent form, and this is found to be due to the larger size of the cells. The leaves, however, are more like *O. lata* than *O. Lamarckiana.* Whether the only primary change, in the production of *O. gigas,* was the doubling of the number of chromosomes, from which resulted the larger cells and hence the larger size of the organs, or whether this is but a part of the original change, can not be determined at the present time.

Evidently all the mutants do not originate in the same way.

O. lata × *O. gigas* has 21 chromosomes (one plant 20), and in reduction ten are regularly segregated from eleven. Two kinds of germ cells are thus produced. Occasionally one chromosome passes to the wrong pole of the spindle, making the reduced numbers nine and twelve. The same irregularity in the germ cells occurs in all the other hybrids examined, and, more rarely, in several of the pure forms. The deviations of one or two from the normal somatic count, which have been observed in several of the forms, are thus simply and easily explained.

Chromosomes of the Somatic Cells of the Œnotheras: Miss ANNE M. LUTZ, Station for Experimental Evolution. (By invitation.)

Root tips of pedigreed plants were used exclusively for these studies and a number of forms were reported upon at the Seventh International Zoological Congress (*Amer. Nat.,* October, 1907).

Œnothera lata (self-pollinated), *O. oblonga* and *O. nanella* had been only hastily examined at the time of the first report, but all have since been carefully studied. The evidence for *O. lata* is not conclusive; 15 chromosomes have been counted, 14, and also apparently 16.

Of the three plants of *O. oblonga* which arose from Dr. D. T. MacDougal's self-pollinated *O. lata* (original seed from England), one showed 14 chromosomes and the remaining two 15 each in every root tip studied.

Three plants of *O. nanella* (seed from Holland, pure bred about 15 generations) gave 14 chromosomes each in *A* and *B* and 15 in *C* in every countable figure.

Mr. R. R. Gates has reported the sporophyte number of chromosomes for plants said to be *lamarckiana* arising from a cross between *O. lata* ♀ and *O. lamarckiana* ♂ to be about 20 (SCIENCE, February 15, 1907; *Bot. Gaz.,* February and July, 1907). Of the seven offspring of a similar cross which were identified as *O. lamarckiana,* I have found each plant to have 14 chromosomes in the cells of the root tips. Two seedlings of *O. albida* arising from this cross had each 15.

Effects of Exposing Germ Cells to the Rays of Radium: Dr. C. S. GAGER, New York Botanical Garden.

At the 1907 meeting of Section G of the American Association for the Advancement of Science I announced that certain results had been obtained by exposing egg and sperm cells of *Onagra biennis* to radium rays, and that these effects were character changes that gave promise, if inherited, of being of specific value. During the past summer these plants matured, and seed has been gathered for the F_2 generation. Results in the F_1 generation were in part as follows:

1. *Functional Asymmetry.*—One side of the plants grew faster and more vigorously than the other, though subjected to perfectly uniform environmental conditions.

2. *Morphological Asymmetry.*—On one side the leaves possess the characteristics, not of the typical *O. biennis,* but of one of its mutants.

3. *A Plant having Two Shoot Systems on One Root.*—One of these systems possessed the characteristics of the typical *biennis,* the other of one of its mutant derivatives. This plant, and the morphologically asymmetrical ones described above, and interpreted as probably sectorial bud-sports, indicate a fundamentally hybrid nature of the plants thus sporting. The characters of the two diverse parents separate out in the bud-sporting, and the parental characters of one of the parents have never found expression in a mature ancestor in the direct line, but have existed only potentially in the parental gamete.

Effects of Radium Rays on Mitoses: Dr. C. S. Gager, New York Botanical Garden.

Root tips of *Allium cepa* were exposed for various lengths of time to rays from radium bromide contained in sealed glass tubes. Exposure was made by placing these tubes close to, but not touching, the roots growing from bulbs in a moist chamber. Thus the α rays were eliminated, only the β and γ rays being able to pass easily through the walls of the glass tube. For purposes of comparison control (unexposed) tips, grown under precisely similar conditions, except for the absence of the rays, were collected at the same time as those exposed.

Examination showed various irregularities in the mitoses in roots exposed to the rays. Exposure to the strongest radium (1,500,000 activity) for a given period completely inhibited nuclear division. With less active preparations and varying lengths of exposure there resulted various disturbances to the chromosomes, some of them lagging behind in the passage from the equator to the poles of the spindle. At times some of the chromosomes appeared to have been accelerated in their passage, even having gone beyond the poles. It was frequently observed that some of the chromosomes failed entirely to pass to the poles, and, consequently, were not included in the formation of the daughter nuclei. This elimination of chromatin from the daughter cells may explain morphological changes in a zygote, following exposure of the fusing gametes to the rays. In one instance the daughter nuclei have apparently separated into two distinct parts, roughly giving the appearance of two nuclei in each daughter cell.

The Relation of Bursa Heegeri to Bursa bursa-pastoris: Dr. G. H. Shull, Station for Experimental Evolution.

Before the beginning of my experiments *Bursa Heegeri* was known with but one type of rosette, apparently agreeing with one of the elementary forms of *Bursa bursa-pastoris* which I had previously shown to possess two dominant Mendelian units in the lobing of its leaves. Upon crossing *B. Heegeri* with that form of *B. bursa-pastoris* which had the corresponding recessive characters, the second generation showed the same four types of rosette, previously secured in a cross between the

two corresponding elementary forms of *B. bursa-pastoris,* and appearing just as in that case in the ratio, $9AB : 3aB : 3Ab : 1ab$. This ratio appeared in combination with each type of capsule, so that *B. Heegeri* now exists with four types of rosette.

The form of capsule is a perfectly alternative character, but the F_2 hybrids have the *Heegeri* type of capsule in only one in 18 to 25 individuals.

The fact that *B. Heegeri* has the same Mendelian units in its leaves as are possessed by *B. bursa-pastoris* is held to further confirm its direct derivation from that species.

By hybridization many elementary forms are produced from a small number of initial mutations, and the whole series of such elementary forms occurring in one species may be paralleled in a nearly related species by the same means.

The smallness of the ratio of occurrence of the *Heegeri* type of capsule indicates that that species owes its capacity for self-maintenance in competition with its parent, to the comparative infrequency of cross-fertilization.

The Effect of Heat on the Starch Grain: Professor H. KRAEMER, Philadelphia College of Pharmacy. (By title.)

The Relation of Plant Societies to Evaporation: Professor E. N. TRANSEAU, Eastern Illinois State Normal School.

Methods for the Control and Measurement of Soil Moisture: Dr. BURTON E. LIVINGSTON, Carnegie Institution of Washington.

For controlling soil moisture, a porous cup (of the form used in the evaporation studies described in Publication No. 50 of the Carnegie Institution and in the *Plant World* for December, 1907) is connected by rubber stopper and glass, rubber or lead tubing to a reservoir of water, and the cup is buried in the soil of the pot or other culture container. After equilibrium has been attained, water is taken into the soil only as fast as it is removed. The height of the reservoir, and hence the length of water column to be lifted, determines the amount of moisture which will be maintained in the soil. The reservoir may be of any size, so that the culture may be continued for an indefinite period without attention. The device for measuring soil moisture is essentially the same apparatus as that just described, so arranged that the cup may be filled and emptied at will by means of two tubes which extend above the soil surface. The rate of water flow into the soil, taken for a short period beginning with the filling of the cup, is an index to the attraction of the soil for moisture, and therefore to its moisture condition, the instrument having been previously calibrated for the particular soil question.

Some Unsolved Problems of the Prairies: H. A. GLEASON, University of Illinois.

Rapid settlement has almost completely destroyed the prairies of the eastern arm of the prairie province, leaving a number of important ecological questions unsolved. Among them are: (1) The original causes which led to the occupation of the territory by forest rather than by prairie; (2) the order of invasion of the prairie flora; (3) the manner and rate of invasion of the forests from the southeast; (4) the relation of prairie fires to the forest; (5) the tension lines between the upper austral prairies and the transition forest on the north and the lower austral forest at the south; (6) the structure and composition of the prairie associations. Some of these can never be solved completely, but careful studies on the scattered fragments of prairies still available may even yet do

much to give a clearer idea of the ecology of the original prairies.

Type Specimens of American Grasses in European Herbaria: Professor A. S. Hitchcock, Bureau of Plant Industry.

In order to complete a revision of the North American species of *Panicum* it was necessary to consult the types deposited in European herbaria. The following list of collections consulted may be of interest to those who contemplate doing similar work, for the exact location of some of these is not generally known.

Antwerp: Herbarium of Dr. Van Heurck. Collection of Salzmann from Bahia.

Brussels: Jardin Botanique de l'Etat. Collection of Galeotti from Mexico. Some Fournier types.

Paris: Muséum d'Histoire Naturelle. General herbarium: types of Desvaux, Steudel, Fournier, Richard, Kunth (H.B.K.). Segregated: herbaria of Michaux and of Lamarck; herbarium of Cosson with some Poiret types; and of Drake del Castillo with some Michaux types sent by Richard.

Madrid: Jardin Botánico. Types of Lagasca and Cavanilles.

Florence: Orto Botanico. Types of Poiret (cited in Encyc. Suppl. as "herb. Desfont.").

Padua: Orto Botanico. A collection of Bosc from Carolina.

Geneva: Herbarium. Delessert and the private herbaria of de Candolle and of Barbey (Herb. Boissier).

Munich: Botanisches Museum. Collection of Martius from Brazil, with types of Nees and Döll.

Vienna: K. K. Naturhistorisches Hofmuseum.

Graz: Private herbarium of Professor Hackel, now at Attersee.

Prague: Collection of Haenke with Presl's types; part at the Botanical Garden of the German University and part at the Bohemian Natural Museum.

Halle: Botanischer Garten. Professor Mez allowed me to consult the collections of Panicum loaned him by several institutions.

Leipzig: Botanischer Garten. No grass types from America.

Göttingen: Botanischer Garten. Types of Grisebach (Wright's Cuban plants and types from Argentina) and of Meyer (Prim. Fl. Esseq.).

Berlin: Botanischer Garten at Dahlem. Types of Link, Sprengel, Kunth, C. Mueller and Nees (Sellow plants from Brazil). The Willdenow herbarium is segregated.

St. Petersburg: Herbarium Trinius at the Imperial Academy of Sciences and the general collection at the Botanical Garden with Fournier's types based on plants of Karwinsky and F. Mueller.

Stockholm: Natural History Museum. Herbarium of Swartz's West Indian plants and the types of Fries and Lindmann from Argentina.

London: Three large collections. Royal Gardens at Kew, with types of Grisebach (Fl. Br. W. I.), Bentham and Pursh. British Museum (Dept. Botany), the collections of Walter and of Sloane, segregated and those of Raddi, Rudge, Robert Brown, and Gronovius. The Linnean herbarium at the rooms of the Linnean Society.

The Bisexual Inflorescence of Humulus lupulus: Dr. W. W. Stockberger, Bureau of Plant Industry.

Humulus lupulus L. is regarded as a strictly dicœcious plant, but at rare intervals cultivated forms of the common hop have been observed bearing on the same flowering branches both staminate and pistillate flowers. By several observers these pistillate flowers are regarded only as aborted

forms of the staminate flowers. For several years this phenomenon has been frequently observed by the writer on the Pacific coast. The anthers of the staminate flowers in all the cases examined bore mature pollen grains. The pistillate flowers also were normally constituted. It appears, therefore, that the determinants requisite for the production of gametes of each sex are present in the cells of the plant usually spoken of as female. It is possible that we have here a modification in the habit of the plant produced by the conditions of culture. The inherence of the determinants of each sex in a single plant is further shown in the somewhat rare cases in which a plant reproduces by means of runners. In the wild state and under certain conditions of culture the underground runners of the hop plant occasionally send up shoots which when mature bear flowers of the opposite sex.

The Possible Rôle of Light in Relation to Alpine Plants: Professor C. H. SHAW, Medico-Chirurgical College, Philadelphia.

Readings with the actinometer and black bulb thermometer *in vacuo* in the Selkirks seem to prove that, as is commonly believed, light at high altitudes is considerably more intense than on adjacent lowlands and that the difference is chiefly in the refrangible end of the spectrum.

Cultures of plants were made by the writer and Mr. William Moore under experimental conditions. When *additional* blue-violet light was allowed to fall on plants growing in ordinary daylight, the plants exhibited a distinct structural response. Leaves were more hairy, and internodes shorter than in the control series.

The whole question is therefore open, with the probability that the character of light at high altitudes may have a morphogenic value differing from that at low altitudes.

The Causes of Timber Lines on Mountains; Snow as a Mechanical Agency: Professor C. H. SHAW, Medico-Chirurgical College, Philadelphia.

The phenomena of timber line are not adequately explained by the factors which have been assigned. The timber lines of the White Mountains and Adirondacks can well be referred to the drying action of cold winds, but not so those of the Selkirks. In this case snow, acting as a mechanical agency, plays the chief part. It may do so in two ways:

(*a*) Small trees are directly broken and abraded by weight of snow or by snow creep.

(*b*) Small trees and lower branches which are long held under the late-lying, wet beds of snow, suffer a sort of drowning and become a prey to fungi.

When the struggle of trees for existence is primarily with wind, their height is limited, they grow thickly in level-topped societies, and the upper outposts of the forest are in local depressions or sheltered spots. Wind-cripples have dead or dying tops, often with entire loss of the conical shape; the growth of their branches is limited to a critical line. This leads to a densely branched and often one-sided habit.

On the other hand, when the struggle of trees for existence is primarily with snow, the forest as altitude increases is resolved into groups of trees. These become more separated, and the upper groups of the trees occupy ridges and local elevations. Snow-cripples possess the spire form, with flourishing upper shoots, but the lower branches and foliage are dying or dead, broken by snow and attacked by fungi.

The alpine fields of the Selkirks, which begin at about 6,000 feet, are thus chiefly due to snow. Higher up the characteristic forms of wind-cripples are seen.

It is suggested that the present ideas may be of application to the Alps as well.

Cultures of Uredineæ in 1907: Professor J. C. Arthur, Purdue University.

Eighth annual report on culture work with plant-rusts. Nearly one hundred collections with resting spores and a fifth as many with active spores were employed. The culture of seventeen species was attempted, with only negative results. Thirty species were grown with success, eight of which are now reported for the first time. Of the latter *Puccinia vexans* and *P. Cryptandri* were grown from amphispores, being the first amphisporic cultures ever made. Three sedge rusts were connected with æcial forms, an *Allium* rust carried through its cycle and two species of *Gymnosporangium, G. Betheli* and *G. inconspicuum* connected with æcial stages.

Notes on Certain Rusts, with Special Reference to Their Peridermial Stages: Dr. G. P. Clinton, Connecticut Agricultural Experiment Station.

The *Peridermiums* (a form genus which occurs on coniferous hosts) are the æcial stages of heterœcious rusts which belong, in their telial stages, to at least seven different genera as now recognized. So far there have been found in North America forty-nine species belonging to these genera, while only thirty species of the *Peridermiums* are known here. Investigations so far have definitely connected only a few of these species. Shear has shown that *Peridermium cerebrum* belongs to *Cronartium Quercus;* Kellerman, that *Peridermium Rostrupi* belongs to *Coleosporium Campanulæ;* and the writer, that *Peridermium acicolum* belongs to *Coleosporium Solidaginis.* European investigators have solved the relationships of three or four other species whose æcial or other stages have been found here, but these results have not yet been confirmed with American material; and American writers have suggested the possible relationship of a few more species. During the past year the writer made a special study of the various stages of such of these rusts as occur in Connecticut, with the result that through field observations, confirmed by indoor inoculation tests, the relationships of two more species are now known. *Peridermium pyriforme,* which was found on *Pinus sylvestris* and *Pinus rigida,* was found to be the æcial stage of *Cronartium Comptoniæ* on *Comptonia asplenifolia;* and *Peridermium consimile,* on *Picea nigra,* was connected with *Melampsoropsis Cassandræ,* on *Cassandra calyculata.* Some evidence was also obtained that possibly *Peridermium Peckii,* on *Tsuga canadensis,* is the æcial stage of *Chrysomyxa albida,* on *Rubus hispidus;* but further proof is needed before this can be stated positively, since there are certain points in their structure that also make it unlikely that they have any relationship.

Further Studies of the Anthracnoses: Dr. C. L. Shear and Miss Anna K. Wood, Bureau of Plant Industry. (By title.)

Sporangia, Conidia and Zygospores in the Genus Choanephora: Professor A. F. Blakeslee, Connecticut Agricultural College.

Choanephora curcubitarum (B. & Rav.) is one of the mucors found not infrequently infecting withered squash blossoms and causing a soft rot of the fruit. Up to the present time only the *Œdocephalum*-like conidial stage has been found in this country and its connection with the mucors has been somewhat in doubt. By cultivating the fungus at a temperature of about 25° C. under proper conditions of moisture, the writer has obtained the sporangia and the zygospores. The species is heterothallic and its (+) and (—) races

have been secured from various localities in this country and in South America.

The Development of the Ascocarp of Melanospora: Professor J. B. OVERTON, University of Wisconsin. (By title.)

Progressive Cleavage in Didymium: Professor R. A. HARPER, University of Wisconsin. (By title.)

On the Development of Immunity for Heart-rot Diseases in Trees: Dr. HERMANN VON SCHRENCK, Missouri Botanical Garden. (By title.)

The Influence of the Swaying of the Wind on the Formation of Mechanical Tissue in Plants: Professor F. C. NEWCOMBE, University of Michigan. (By title.)

A Study of Edaphic Conditions in Peat Bogs near Ann Arbor: Dr. G. P. BURNS, University of Michigan. (By title.)

DUNCAN S. JOHNSON,
Secretary

JOHNS HOPKINS UNIVERSITY

SCIENTIFIC BOOKS

Evolution of Mammalian Molar Teeth to and from the Triangular Type. By HENRY FAIRFIELD OSBORN, Sc.D., LL.D., D.Sc. Edited by W. K. GREGORY, M.A. Pp. 250. New York, The Macmillan Company. 1907.

This book, the most valuable contribution to mammalian odontology since that of Sir Richard Owen, consists of a series of collected and revised researches upon trituberculy with new sections on the forms and homologies of the molar teeth in the different orders of mammals. The theory of trituberculy was a conception of the late Professor Cope, but was elaborated by Professor Osborn, who has been by far the greatest exponent of the idea. Four principles have been developed in connection with the general theory: (1) That in the most primitive Tertiary mammalia there are "*three main tubercles on the crowns of both upper and lower molars, disposed in triangles*"; primitive trituberculy. (2) Origin of the tritubercular types from the single reptilian cone. "*The tritubercular type sprang from a single conical type by the addition of lateral denticles.*" (3) Cusp addition or differentiation; "a process analogous to budding or outgrowth in other tissues." An opposing theory to this is that of concrescence. (4) Reversed upper and lower triangles. "*In the lower molars the reptilian cone is external and the two denticles internal, while in the upper molars the reverse is the case,* namely, *the reptilian cone is internal and the denticles are external.*" It is on this principle that the Osbornian nomenclature, implying a serial homology between the cusps of the upper and lower molars, is based. As applied to the lower molars this principle is generally accepted; but as applied to the upper teeth, it has been most vigorously opposed in the light of three different classes of positive evidence—embryological, anatomical and paleontological. The embryological evidences seem to point to the antero-external cone (Osborn's paracone) as of the greatest antiquity and therefore the reptilian cone. This is also borne out by the analogy of the premolar cusp development (premolar-analogy), and by that of the lower molars. Evidence in favor of Osborn's theory is derived from paleontology, and is also shown by the mechanical development of the cusps, while on the other hand recent interpretation by Gidley of paleontological evidence is in harmony with that of embryology and with the premolar analogy theory.

In the summary of his introduction Professor Osborn says: "That the four great principles of molar evolution *do not stand or fall together.*" The first principle, that of primitive trituberculy, is now almost undeniable; the *reptilian cone origin* theory next in order of demonstration and acceptance; the *cusp addition* theory finding at present more advocates than the opposing idea of concrescence. Finally the greatest conflict of evidence occurs with reference to the homologies of the upper and lower cusps. There is no middle ground; either the Cope-Osborn theory is correct and the premolar-analogy plus the embryological theory wrong, or the reverse is true.