to strive with each other. But the final outcome will be that the president of the university will be the executive representative or spokesman, not the ruler of the faculty, and the department head will stand in similar relations to his fellows. Meanwhile the title is an academic honor, the salary a practical means to an end, and so long as our universities are in process of formation, the two will not bear any automatic or static relation to each other.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

MEETING OF SECTION G (BOTANY)

SECTION G held three independent sessions for reading of papers, December 28 and 31, 1906, in the rooms of the botanical department, Schermerhorn Hall, Columbia University. The attendance ranged from about thirty at the last session, when the Botanical Society was holding a simultaneous meeting, to about one hundred and twenty-five. On December 28 a joint session with Section F (Zoology) was held at Teachers College, at which over three hundred persons were present. Owing to the absence, on account of illness, of the retiring vice-president, Dr. Erwin F. Smith, the hour assigned for his address was used for other papers.

During the past year there has been effected a union of three affiliated societies, viz., the Botanical Society of America, the American Mycological Society and the Society for Plant Morphology and Physiology, the combination bearing the name of the oldest and first mentioned of the three. This has simplified somewhat the relations of other botanical interests with Section G. The new Botanical Society held two sessions in which members of the section were largely present, the attendance then being over one hundred; one of these sessions was held at the New York Botanical Garden, Bronx Park, after which all the visiting botanists were entertained at luncheon by the garden. The society held two sessions on December 31, simultaneously with Section G.

Forty titles were submitted for the program of Section G, from which about thirty papers were actually presented. The first six of the following were read before the joint session with Section F.

Elementary Species and Hybrids of Bursa: GEORGE H. SHULL, Station for Experimental Evolution, Cold Spring Harbor, New York. (To be published in SCIENCE.)

Mendel's Law as a Tracer of Lost Parents —I. The American Carnation: J. B. NORTON, U. S. Department of Agriculture.

In this paper it will be shown that the common greenhouse carnation is a hybrid type whose two parents are a single form and a very double form. These parental types have been extracted by ordinary breeding methods and recombined to produce a uniform hybrid first generation agreeing with the standard commercial types. This is the first experiment, so far as the author knows, that shows a commercial application of Mendel's law of heredity.

Preliminary Note on Pollen Development in Œnothera lata De Vries and its Hybrids: R. R. GATES, University of Chicago.

Œnothera lata is one of the mutants which does not mature its pollen, and hence must be pollinated from another species, producing a hybrid in the next generation. The plants studied were from a cross between *O. lata* and *O. Lamarckiana,* which is a Mendelian hybrid, showing in the next generation, according to De Vries, an aver-

age of 15 per cent. *O. lata* plants, the remainder being *O. Lamarckiana,* the pollen parent.

It is found that pollen development in *O. lata* may proceed to the formation of tetrads. The later stages are very irregular and result in complete degeneration of the pollen cells, usually long before maturity. This degeneration may begin in some cases as early as the synapsis stage. Irregularities in the distribution of the chromosomes in the reduction divisions give rise to small extra nuclei in the pollen tetrads, and other conditions similar to those found by Juel in *Hemerocallis fulva* and *Syringa Rothonagensis* (a hybrid), by Tischler in hybrids of *Ribes,* by Guyer in hybrid pigeons, and others. The prevalence of the condition, especially among sterile hybrids, suggests that it may prove to be a distinguishing characteristic of certain classes of hybrids.

The sporophyte number of chromosomes in *O. lata,* as determined in the prophase of the heterotypic mitosis in the pollen mother cell, is 14; while the sporophyte count for the *O. Lamarckiana* side of the cross is at least 20. The conclusion from this is that the pure *O. Lamarckiana* itself must have over 20 chromosomes. It is believed that differences among the chromosomes of *O. Lamarckiana* and its mutants may furnish a cytological basis for discontinuous variation, and hence a count of the chromosomes in *O. Lamarckiana* and other mutants is to be made at once to settle this important point.

In both sides of this cross the heterotypic mitosis in the pollen mother cell shows one, or more commonly two, ring-shaped chromosomes with a peculiar history. They may be designated heterochromosomes. In *O. lata* their origin has been traced. They arise during synapsis, apparently by the cutting off of a loop of the spireme, for in earlier stages of synapsis the whole spireme is continuous. One or two of these bodies may be formed as large rings or closed loops some time before the rest of the spireme breaks into chromosomes. Later they are found, much condensed in size, on the spindle; but in metaphase they have generally wandered towards the poles or out into the cytoplasm, where they probably disintegrate. Their possible significance in connection with the phenomena of mutation will not be discussed now. The full paper will appear shortly.

On the Behavior of the Seedlings of Certain Hybrids of Viola: Ezra Brainerd, Middlebury College, Vermont.

Many violet hybrids are found in the second generation to revert in some characters to one of the parent species, and in other characters to the other parent species. Illustrations are given of this in four particulars: (1) in leaf-outline; (2) in pubescence; (3) in size; (4) in color of capsule and of seeds.

The tendency of certain individuals to recover from impairment of fertility is shown.

Illustrations are given of the way in which species may arise by the attainment in the more marked hybrid forms of fertility and stability in reproduction.

Origination of Species by Hybrids among Wild Plants: D. T. MacDougal, Carnegie Institution. (To be published in the *Botanical Gazette.*)

An Instance of Natural Hybridization: W. W. Rowlee, Cornell University.

In 1896, the writer in conjunction with Dr. Wiegand, published an article in the *Bulletin of the Torrey Botanical Club,* describing as hybrids certain willows that grow in a small peat bog near Ithaca.

The writer was impressed at the time

(and the impression has grown since) with the insecurity of diagnoses of wild hybrids. Inferential evidence must be accepted that the plant is a hybrid in the first place and in the second place the parentage must to a considerable extent be assumed.

The case which came under our observation was perhaps clearer than some others because one of the supposed parents, *Salix candida,* was confined to this particular locality. No other station is known for the plant within a radius of forty miles. The other parent might have been any one of several willows growing near by. The morphological characters of the hybrid pointed strongly toward *S. cordata* as the other parent, and it was so decided in the published paper.

After the publication we undertook to hybridize artificially *S. cordata* and *S. candida,* with the result that duplicates of our wild hybrids were produced. It became at once interesting to inquire into the conditions under which the wild hybrids were produced. As stated above, one of the parents was local. The area covered by the bog is less than an acre. It is completely surrounded with hard ground that was covered in its primeval condition with a heavy growth of trees. After the country was cleared up the owner of this swamp (before 1870) made an attempt to convert it into agricultural land by drainage and tillage, and succeeded to the extent of lowering the water level so that he could clean the surface and in a dry season plow it. The ground proved to be full of copious springs, and in spite of the complete system of ditching, it remained too wet to be manageable. During the period of cultivation *Salix candida* was nearly exterminated. It, however, maintained itself sparsely along the ditches. When the farmer abandoned his attempt at reclamation *Salix cordata,* which grew in abundance in the vicinity, invaded the swamp. A fertile and unoccupied seed-bed was afforded, and plants that found it congenial took possession. Of the shrubs, *Salix candida* and its hybrids apparently succeeded best, and the result is a plantation of very interesting willows, a complete series of which have been taken. It seems highly improbable that these forms appeared in the swamp prior to 1880, as Professor Dudley and other students had studied the flora of this particular place carefully and repeatedly.

The conditions existing in this peat bog have suggested to the writer that the clearing of the country may have given similar opportunities to other species. The numerous forms of *Cratægus* and other types recently described, readily adapting themselves to open conditions, may have had their rise under conditions similar to those in which our hybrids of *Salix candida* developed.

A Natural System of the Discomycetes: F. E. CLEMENTS, University of Nebraska.

Spore Forms of Spegazzinia ornata Saccardo: ERNST A. BESSEY, Subtropical Laboratory, Miami, Florida.

Two spore forms are known for this fungus, one long-stalked with spiny processes and one short-stalked and smooth. According to Saccardo the latter are borne on the spines of the former. Cultures have demonstrated that the forms are independent of one another and arise directly from the fungus mycelium.

Accelerated Blossoming due to Defoliation by Storm: ERNST A. BESSEY.

On October 18, Miami, Florida, was visited by a hurricane of great intensity, lasting about nine hours. The wind attained a velocity of probably seventy-five to eighty miles an hour and possibly still higher for certain gusts. To a considerable extent both native and exotic trees

were defoliated, the loss of leaves varying from that of those at the extremities of the branches to the total defoliation of the tree, often accompanied by loss of branches. Among the trees thus affected were live-oak (*Quercus virginiana*) and mulberry (*Morus rubra*). The former does not shed its leaves normally until the new foliage is fully developed in the spring, thus being evergreen, but the latter is normally without leaves in December and January.

About three to four weeks after the storm, defoliated trees of both species pushed out into flower, new foliage buds beginning to unfold also. The normal time of blossoming is about February 1, so that the time of blossoming was accelerated eight to ten weeks.

It is interesting in this connection to recall the newspaper reports of the Mobile hurricane according to which peaches and other fruit-trees came out into bloom two or three weeks after that storm.

This phenomenon of blooming being hastened by defoliation is not rare. In Paris, in August, 1904, the writer saw horse-chestnut trees that had been defoliated by some insect, pushing out into bloom again. It is by no means unknown in America. Following the freeze at Miami, at Christmas, a pomelo tree was observed which had lost the leaves on one of its large lower branches. This branch was in full flower three weeks after the freeze.

The explanation of the appearance of the blossoms when the trees start to reform their leaves lies in the fact that the flower-anlagen are laid down in the summer so that when the leaves expand the flowers also appear. The fact that the root and trunk cells had not reached the dormant condition is probably the explanation for the fact that the trees defoliated in October produced new leaves and flowers so soon. Possibly if the weather had remained cold for several weeks after the storm the plants might have assumed their winter dormancy.

An Outbreak of the European Currant Rust, Cronartium ribicola Dietr.: F. C. Stewart, Geneva, New York.

Cronartium ribicola is an heterœcious rust having its uredo and teleuto stages on the leaves of various species of *Ribes* and *its œcidium stage* (=*Peridermium strobi* Kleb.) on *Pinus* spp., particularly *P. strobus.* In Europe, where it has been known for fifty years, it is widely distributed and in some regions causes serious injury to *Pinus strobus.* With one possible exception, it has never been collected in America prior to 1906. Accordingly, it is interesting to note that in September, 1906, the writer found it abundant in a currant plantation on the grounds of the New York Agricultural Experiment Station at Geneva, N. Y. In this plantation three species (*Ribes nigrum, R. rubrum* and *R. aureum*) were represented by fifty-four varieties, forty-eight of which were affected. In many cases every leaf on the bush was affected. *R. nigrum* suffered most and *R. aureum* least. Near-by specimens of *R. grossularia,* also, were slightly attacked. The source of infection is unknown. The only specimens of *Pinus strobus* nearby are two apparently healthy trees planted eight years ago 112 meters west of the infested currant plantation. All *Ribes* plants on the station grounds have been destroyed in an attempt to stamp out the disease.

The Origin of the Hymenium in Some Geoglossaceæ: E. J. Durand, Cornell University.

The hymenium of the Geoglossaceæ has been supposed to be free or exposed from the first. Schroeter made this character the distinguishing character of the Helvellineæ. Dietrich called attention to the fact that in *Leotia lubrica* and *Mitrula phal-*

loides the hymenium was at first covered by a delicate membrane or veil, which it breaks through. The writer's observations on several species confirm those of Dietrich. It is probable that in all members of the group the hymenium is at first covered.

Notes on the Embryology of Rhizophora Mangle: MEL. T. COOK, Santiago de las Vegas, Cuba.

Presents many difficulties in technique, owing to the presence of tannin, etc. Only one of the four ovules develops. Integuments develop early and increase the difficulties. Embryo-sac apparently follows the normal course. Embryo has a long filamentous suspensor, the synergid end of which degenerates very early, but the opposite end persists very late. Endosperm very abundant and the outer cells grade almost imperceptibly into the nucellus cells. The cotyledons develop very early at the expense of the endosperm cells and have the appearance of being very much cramped. After the development of the cotyledons is well advanced the root tip begins to grow more rapidly. At the same time the surface cells of the cotyledons become very much modified and very protoplasmic, evidently for absorption. Cells through the entire embryo show evidence of great activity, the vascular system becomes more prominent and peculiar ingrowths from the surface of the cotyledons connect with it. Endosperm almost entirely disappears and the embryo is fed by the mother plant.

The Embryology of Rhytidophyllum Crenulatum and R. Tomentosum: MEL. T. COOK.

Of interest because the family is tropical and subtropical and unworked morphologically. Ovule anatropous. Archesporium a single subepidermal cell which usually does not divide but elongates and produces the normal eight-nucleate sac. Synergids small and staining deeply. Antipodals small and disintegrating early. The polar nuclei unite near the antipodals. Micropyle and pollen tube conspicuous. Entrance of pollen tube obliterates the synergids. Endosperm undergoes primary division before the first division of the proembryo, and the two daughter nuclei are separated by a cross wall which soon disappears. Both nuclei divide rapidly. Micropylar endosperm disintegrates very early. Embryo at first filamentous, followed by a division of the apical cell. Suspensor elongates and appears to function as a haustorium, then disintegrates. Differentiation of tissues does not follow the exact order of *Capsella bursa-pastoris* and other dicotyledonous plants.

Radioactivity a Factor in Plant Environment: C. STUART GAGER, New York Botanical Garden.

The hitherto recognized factors of plant environment may be classified as molar (including living organisms), molecular and undulatory. Radioactivity is an expression of atomic disintegration, and is accompanied by a relatively enormous release of energy. At least four different factors may be included under the term radioactivity, for the breaking down of the atom of a radioactive substance is accompanied by (1) a stream of negatively charged ions or 'corpuscles,' each about one thousandth the size of a hydrogen atom, and moving with about 95 per cent. the velocity of light. Streams of corpuscles constitute the *alpha* rays; (2) a stream of positively charged ions, of nearly twice the size of a hydrogen atom, and moving more slowly than the corpuscles. Streams of positive ions constitute the *beta* rays; (3) an electro-magnetic pulse, analogous to the X-ray, and caused by the starting or stopping of ions. These rays, given off from radioactive substances, are termed *gamma* rays; (4) the

emanation, an inert gas of the argon family, which is radioactive, and whose atoms are, therefore, undergoing a disintegration.

Recent researches lead to the conclusion that the phenomenon of radioactivity is not confined to the so-called radioactive elements, radium, uranium, thorium and others, but is a general property of matter. Not only are the heavier metals, such as lead, zinc, silver, but various other substances, namely aluminum, copper, tin-foil, air from soil, spray at the foot of waterfalls, mud, tap water, petroleum, freshly fallen rain and snow, metal surfaces on which light waves of short wave length impinge, and flames, have all been found to give off a penetrating radiation. It seems probable that radioactivity is a general property of matter. Results already obtained demonstrate conclusively that it is a factor in the normal environment of living things, and its effect on the life processes of plants becomes, therefore, a matter of considerable interest and importance.

Some Effects of Radioactivity on Plants: C. Stuart Gager, New York Botanical Garden.

In ascertaining the effects of radioactivity on plants, it has not been possible satisfactorily to screen out the various kinds of rays, and the emanation, so as to study separately the effects peculiar to each. The results obtained, therefore, must be attributed, almost without exception, to the sum total of all three kinds of rays involved in the radioactivity of radioactive substances. The present paper concerns chiefly the results obtained with radium bromide, of various strengths of radioactivity, used either in sealed glass tubes or in the form of Lieber's radium coating on rods and cylinders.

Experiments lead to the conclusion that the rays of radium act as a stimulus to the physiological processes of plants, accelerating, retarding, or inhibiting, either germination, growth, respiration, fermentation, cell division, starch formation, sensitiveness to gravity, according to the strength of the radium salt employed, the duration and distance of exposure, the intervention of screens, the nature of the tissue and, possibly, the species of the plant.

When the pollen or the ovary is exposed before pollination, or the ovary after fertilization, the resulting seeds produce plants profoundly different in the first generation from that normal for the species. If these modifications shall prove heritable in subsequent generations the ability of radium rays to induce mutative changes will have been demonstrated.

While there is seemingly a very crude analogy between radioactivity (atomic disintegration) and the molecular disintegration involved in destructive metabolism, there is nothing in the former that may be rightly compared, in any way, to constructive metabolic processes. The results of continuous experiments, covering a period of over two years, do not give the slightest support to any theory that radioactivity is, in any real sense, comparable to metabolism, or that the rays of radioactive substances are capable, independently, of elevating inorganic compounds into the condition of living organisms.

The Pathology of the Rice Plant: Haven Metcalf, U. S. Department of Agriculture.

The literature on rice diseases is scanty, and mostly in the Italian, Japanese, Dutch, Russian and Portuguese languages. Fifteen diseases have been described on rice; further research may be expected to demonstrate the identity of several of these, now supposed to be distinct. Eight rice diseases occur in America, of which six were described by the writer in Bulletin 121 of the South Carolina Experiment Sta-

tion. Of these, *blast,* the most serious, is caused by a fungus of the genus *Piricularia,* as the writer has demonstrated by repeated successful inoculations from pure cultures. It is not impossible that further researches will show this disease to be a form of the Italian *Brusone.* Two diseases are increasingly prevalent, and may have been recently introduced into the country: a 'smut,' caused by *Ustilaginoidea virens* (Che.) Tak.; and a stem rot under water, due to *Sclerotium Oryzæ* Catt.

The Production of Toxic Soil Conditions by the Roots of Plants: HOWARD S. REED, Bureau of Soils, U. S. Department of Agriculture.

The author reported the results of experiments demonstrating the excretion of deleterious substances by roots. Roots growing in non-nutrient agar rendered it unfit for further growth. The excretions from wheat were decidedly toxic to a second crop of wheat. The excretions from corn or cowpeas were scarcely, if at all, toxic to wheat. The excretions from oats were quite toxic to wheat but less toxic than those of the wheat itself. Apparently the excretions from the roots of a given plant, or of its near relatives, are more toxic to that species than the excretions from plants belonging to more distantly related species.

The Rôle of Certain Elements in the Physiology of the Plant Cell: HOWARD S. REED.

The author reported the results of experiments made at the University of Missouri. The vegetative bodies of a number of lower plants were cultivated in solutions lacking one of the essential elements. Most of the elements have more or less specific functions to perform, and, within narrow limits, there is no substitution possible. The view was held that the essential elements, in addition to building up tissues, serve as sources of energy to the cell.

Some Mutual Effects of Tree-roots and Grasses on Soils: CHAS. A. JENSEN, Bureau of Soils, U. S. Department of Agriculture.

Seedling trees of maple, dogwood, cherry, pine and tulip were planted in paraffined wire pots and the pots planted to wheat. The pots were of such size as to make a close physical relation of the roots of the two kinds of plants necessary. The pots containing the trees in every instance gave less yields of wheat than the controls, especially during summer months when the trees were physiologically active. Towards the autumn, when the trees were entering upon their seasonal rest, the wheat yields increased, sometimes slightly exceeding those of the controls. Different species of trees also had different effects on the wheat yields. As the experiment was carried on under control of external conditions, it is believed that the bad effect of the tree seedlings on the wheat growth is due to toxic substances excreted by the tree roots.

The Botanical History, Classification, and some Uses of Sorghum: CARLETON R. BALL, U. S. Department of Agriculture.

Andropogon sorghum (L.) Brot. comprises a very large number of domesticated forms. None of them is known to exist in the wild state. The cultivation of sorghum dates from remote antiquity. India and the eastern and central portions of Africa are to-day the two great sorghum centers, both in rich abundance of forms and in the economic use of them. Facts point to the independent origin of numerous cultivated forms in India and in Africa. *A. halepensis,* supposed to be the parent of all cultivated sorghums, is widely distributed over most of these two regions. Introduction into Europe took place in the

early days of the Christian era. The practise of all early botanists was to regard all forms in cultivation as distinct species. Between thirty and forty specific names have been applied to the plant and more than one hundred trinomials in recent years. Identity of the important species and the natural method of classifying and naming forms of a cultivated species. Use of sorghum for human food, forage, syrup, sugar, liquor, building material, firewood, etc.

Periodicity of the Sexual Cells of Dictyota dichotoma: W. D. Hoyt, Johns Hopkins University.

On the coasts of Wales and England *Dictyota dichotoma,* according to Mr. J. Lloyd Williams, bears its sexual cells in regular fortnightly crops. The times at which these crops are produced bear a definite relation to the tides, and the observed behavior is best explained by regarding the increased illumination obtained during the low water of spring tides as the factor which determines the time of fruiting.

Observations made at the laboratory of the Bureau of Fisheries, at Beaufort, N. C., during the past summer show that at this place also *Dictyota dichotoma* produces its sexual cells in regular crops at periods bearing a definite relation to the tides. These crops, however, are borne at monthly, instead of fortnightly, intervals, the time of their production is not influenced by differences in the height of different spring tides, and it seems that light is not the factor that determines the time of fruiting.

Evidences of Sexual Reproduction in the Slime-molds: Edgar W. Olive, University of Wisconsin. (Read by C. A. King.)

Some recent work on the exosporous myxomycete, *Ceratiomyxa,* has shown that a simple form of sexuality exists in this form. Toward the close of the more or less quiescent cleavage stage, the nuclei of the plasmodium fuse in pairs, so that the uninucleate protospores which result from cleavage each contain a large fusion nucleus. The chromatin of this large nucleus soon appears to become shrunken, or rounded up in a dense ball, at one side of the large nuclear cavity, thus resembling strikingly the condition which has been termed synapsis. That this condition is really a true synapsis, and not an artifact, is suggested by the two rapidly recurring nuclear divisions which, after a short period of rest, follow. These facts appear to indicate that a reduction phenomenon takes place at this time, similar to that which takes place in the spore mother-cells of higher plants. As a result of the double division, each mature spore of the final fructification comes to contain four nuclei.

We thus note that in the life history of this form, we have presented the three morphological stages, which, as pointed out by Blackman and others, occur in connection with the complete sexual cycle, viz., (1) *cell fusions* (when the many myxamœbæ unite to form the plasmodium); (2) *nuclear fusions* (in pairs, near the close of the development of the fructification); followed immediately by the third stage, *chromatin fusion* (associated with synapsis and the subsequent reduction division). As has been pointed out, more or less wide gaps may separate these successive stages in different plants. In *Ceratiomyxa,* we obviously have a condition comparable to that in the rusts, since cell fusion is far separated from the final nuclear and chromatin fusions.

As Blackman has further pointed out, the late nuclear fusion in the rusts has to do with the reduction phenonema which immediately follow, and he holds the opinion that the stimulus to development—fertilization proper—is imparted by the

earlier cell fusions. In *Ceratiomyxa,* the conditions appear essentially similar.

Although the numerous nuclei in the plasmodium do not apparently maintain the paired relation seen in the rusts, at least until just before spore formation, yet notwithstanding this fact, the plasmodium may be regarded as similar to the binucleate condition in the rusts, and therefore as a sporophyte stage. The 4-nucleate spores, together with the several generations of swarm-spores and myxamœbæ, would, according to this view, constitute the gametophyte development.

Localization of Plants in the Finger Lake Region and the Adjacent Ontario Lowlands of Central New York: W. W. ROWLEE, Cornell University.

The author gives a description of the physiographic features of central New York, pointing out that Onondaga, Oneida and numerous small lakes on the Ontario lowlands are strikingly different from those of the lakes of the Finger Lake Region proper.

The subject discussed in the paper deals principally with localized or rare plants in these two regions. A list of species is taken up and discussed under the three headings: (*a*) plants of recent introduction, (*b*) plants requiring peculiar conditions, (*c*) plants with no apparent cause for limited range. The paper is devoted particularly to plants of the last category, and it is pointed out that one and the same species is scarcely ever localized in both regions. Either a localized species of the uplands does not occur in the lowlands, and *vice versa;* or a species localized in the highlands will be relatively abundant in the lowlands, and *vice versa.* Again it is noted that the localized species of the highland region occur with few exceptions in wooded uplands, while those of the lowlands are confined mainly to the lakes and watercourses and their immediate vicinity.

The author concludes that in the Ontario lowland region the waterways have directly or indirectly been responsible for the introduction of the localized species, and the fact that almost all of them are at their extreme northern range indicates that they are an element of the south Atlantic coast flora at its extreme limit of endurance.

Agrostological Field Notes for 1906: A. S. HITCHCOCK, U. S. Department of Agriculture.

Outlines of two field trips: (1) Southern States, March–April, (2) Rocky Mountains, July–August. Methods of study of grasses in the field. Kind of notes necessary to take in studying the variation of a species. Results as applied especially in the genera *Panicum* and *Poa.*

By visiting type localities many doubtful species of *Panicum* of the southern states were satisfactorily worked out.

Classification of the Paniceæ: Mrs. AGNES CHASE, United States Department of Agriculture. (Read by title.)

The Sub-aerial Absorption of Water; a Function of the Ligule and Stipulaceous Tissue of the Grasses: F. L. STEWART, Murrysville, Pa.

This paper gives the results of experiments extending over a series of years; disclosing the existence of an adjustment of the external to the internal structure of the grasses whereby the moisture of the atmosphere by a system of condensation, conduction, temporary storage and absorption enters into the circulation of those plants, contributing to their nutrition and thus supplementing the supply derived from the roots.

'G' Trees: S. M. TRACY, Biloxi, Miss.

Describing a peculiar form of *Pinus Tæda L.* which occurs frequently in southern Mississippi, though very rare in other

sections. Paper accompanied by photographs.

Parasitism of Buckleya distichophylla (Nutt.) Torr: Samuel M. Bain, University of Tennessee.

This shrub, known from only a few localities in the Tennessee and North Carolina mountains, is parasitic on the roots of other trees. Like its Japanese congener, *B. Quadriala,* it has several hosts, and was found growing on *Fagus americana, Pinus virginiana* and *Tsuga canadensis,* and doubtless occurs on other species. Specimens growing on *Tsuga* appeared more robust than those growing on other hosts.

The Plant Disease Survey of the United States: W. A. Orton, Bureau of Plant Industry, U. S. Department of Agriculture.

The department has for many years collected information and statistics in regard to the distribution and prevalence of plant diseases in the United States. Beginning in 1899, an annual summary has been published in the appendix to the year book. In 1905 the scope of the survey was extended by the adoption of a plan for securing the active assistance of plant pathologists in some of the experiment stations, who were made collaborators in the department. It is expected that the work will be further extended as circumstances permit.

The object of the survey is to gather facts that will serve as a basis for the study of the science of the geographical distribution of plant diseases. It is desired, first, to learn and record the distribution of plant diseases throughout the country; second, to record the varying prevalence of these diseases from year to year, and the losses caused by them; third, to study the conditions governing the development and spread of plant diseases, including the relation of weather conditions, association of crops, the invasion of the host by its parasite and the natural resistance of varieties; fourth, to bring together a collection of specimens representing the distribution of plant diseases in the United States, which will assist in settling questions that may arise in the future respecting these matters; fifth, to summarize the additions to our knowledge of plant pathology, and the progress made in the treatment of plant diseases, and to make all this information available to workers everywhere through the files and collections open for reference in Washington, the publication of an annual summary in the year book, and through more complete reports in bulletin form to be published at intervals of a few years.

Such a project can be carried out only by a national organization like the Department of Agriculture. The underlying purpose in carrying on this work is to assist the collaborators by bringing them into closer touch with farmers and others in their states, as well as with the department, and to aid them in the investigations of their special problems.

There is a growing interest in the geographical distribution of plants and their relation to each other and to their environments; it is hoped that similar interest can be aroused in studies of the distribution of plant diseases and the important scientific and economic problems growing out of this line of work. The cooperation of many observers is required for the successful accomplishment of such a survey. It is the purpose of this paper to request the aid of all interested persons.

Fasciation in the Œnotheras: Alice Adelaide Knox, Carnegie Institution.

Fasciation in the *Œnotheras* is caused by mechanical injury due to the attacks of insects in the meristems of the growing tips. In the material studied most of the injuries came from moths, species of *Mompha,*

which live parasitically upon the primroses through part of their development. This relates both to ring-shaped and to simple fasciations.

Experiments upon the heredity of fasciation prove that in these forms the seed of normal plants produces as many flat stems as the seed of banded plants. In the *Œnotheras* the phenomena leading to fasciation are those of traumatism.

A Recording Evaporimeter: BURTON EDWARD LIVINGSTON, Desert Botanical Laboratory.

The author describes and exhibits a newly devised instrument for studying the daily march of the evaporation rate. It consists of a porous clay cup filled with distilled water and connected with a reservoir by a tube in which is placed an electric valve. A U-tube mercury contact is provided, by which an electric current flows to open the valve when a cubic centimeter of water has been evaporated from the porous cup and thus removed from the instrument. The same column of mercury makes a second contact and causes the valve to close when a cubic centimeter of water has flowed into the apparatus from the reservoir. An electric pen, drawing a continuous horizontal line upon a paper slip carried on a daily rotating drum, is raised slightly each time the valve is opened, and thus a short vertical line is drawn upon the record for each cubic centimeter of water evaporated. The spacing of these lines of course constitutes a record of the varying time intervals required to evaporate that volume. This instrument is available for recording the rate of loss of water, or of any liquid which can be used with a glass stop-cock, from any given container. For example, it can be used to produce a recording potometer for experiments upon plant transpiration.

The following papers were read by title owing to the absence of the authors when called for:

A Composite Lycopod Type from the Devonian: DAVID WHITE, U. S. Geological Survey.

This paper describes the remarkable fossil tree trunk illustrated in the New York Geological exhibit at the American Museum of Natural History. The fossil, which is extraordinary for its size and completeness, is very important systematically, since it combines certain features that serve to distinguish the later Lepidophytic groups. Most conspicuous of these are the *Sigillaria* form of leaf cushion in the lower part and the *Lepidodendron* form in the upper part. The fossil is one of the more highly developed representatives of an ancestral type *Archæosigillaria.*

Hybridization a Factor in Migration and Competition: E. N. TRANSEAU, Alma College, Michigan.

The increasing list of plants which form Mendelian hybrids by cross pollination with closely allied species and varieties necessitates the consideration of pollen dissemination in estimating the mobility of such species. The ease with which varieties of corn may be dispersed through pollination is a familiar example. Such hybrids are uniform in the first generation, but in the second (F_2) are resolved and produce some pure individuals of each parent type. A newly arisen variety of a widely dispersed species may by this means have its mobility greatly increased beyond that due to seed and vegetative propagation alone.

Competition in nature may involve several generations. In such cases factors other than the purely physical must be taken into account. The ability of a newly arisen variety to form Mendelian hybrids carries with it the chance of being carried over unfavorable seasons in the heterozy-

gote condition, which may determine the failure or success of the plant in establishing itself in a given habitat. In the case of competition between a mutant and its parent form, the chances of persistence of the former may be increased or decreased through hybridization, according as they Mendelize or produce constant hybrids.

Species which hybridize readily afford a method for the quantitative study of cross pollination.

The Morphology of Lemna trisulca: Otis W. Caldwell, State Normal School, Charleston, Ill.

The sporophyte body is regarded as composed of stem, root and leaf, not as an 'undifferentiated shoot.' Floral structures, by their relative position and age indicate that there is instead of a single flower an inflorescence consisting of one carpellate and two staminate flowers all borne on a greatly reduced spadix. Carpellate and ovular structures indicate relationship with the more complex Araceæ.

The tapetal cells may grow into the loculus, become multinucleate and almost join cells from the opposite side. Spore mother cells may act in the same way. Spore mother cells and spores may disorganize at any time.

No case of indirect division in the germination of the microspore was found, the divisions observed being amitotic.

The female gametophyte rarely matures, the ovular structures disorganizing at any time. Vegetative reproduction is depended upon almost exclusively. Seed production is seldom attempted and almost completely unsuccessful.

The Structure and Wound-Behavior of the Cedar of Lebanon: Edward C. Jeffrey, Harvard University.

The Abietineæ are divisible on anatomical and reproductive characters into two distinct subgroups, the Pineæ and the Abieteæ. The former are characterized by deciduous cones with non-deciduous scales, by the resin canals of their secondary wood, and by the peripheral resin canals of the primary xylem of the root. The latter by non-deciduous cone axes with deciduous scales, by the absence of resin canals in the secondary wood and by the median resin canal of the primary xylem of the root. The cedar is distinguished among the Abieteæ by the fact that it forms, as a result of injury, resin canals in the secondary wood both in the vertical and in the horizontal planes, which are continuous with the resin canals outside the woody cylinder. Further in the primary wood of the root, although the median single resin canal, which is characteristic for the Abieteæ, is present it is often accompanied by apparently vestigial peripheral marginal canals, similar to those found in the Pineæ. These facts together with the great geological age of *Cedrus* (older than any others of the Abieteæ) tend to show that it is the most primitive of the Abieteæ and has come from the same parental stock as the Pineæ.

Tyloses in the Tracheids of Conifers: Mintin A. Chrysler, Harvard University.

Tyloses have been regarded as normally absent in the tracheids of conifers. An examination of the heart wood of the root shows that in various species of *Pinus* true tyloses occur. These are in the form of vesicular outgrowths from adjacent medullary ray cells, and are found in all stages of projection into the tracheids. They are quite distinct from the tyloses which have long been known to be present in the resin ducts, and among the conifers seem to be confined to the genus *Pinus,* where they occur in all the species yet examined.

The Homologies of the Medulla in the Filicales: J. Horace Faull, University of Toronto.

Two views are held in regard to the medulla in the stems of the Filicales, one that it is of stelar, the other that it is of extrastelar origin. These two conceptions lead to two divergent views of the stele—to the two leading stelar hypotheses.

The author of this paper holds to the view that the medulla is of extrastelar origin—excepting the parenchymatous tissue that may appear in the center of the stele at the base of seedlings in certain cases. The following facts seem to favor the correctness of this view: (1) The similarity of cortical and medullary tissues. (2) Their continuity through foliar and ramular gaps. (3) The 'intrusion' of the cortex above the origin of leaf traces near base of many filicinean seedlings. (4) The actual enclosing of a portion of the cortex to constitute a pith at the base of adventitious shoots, where a protostele passes into the siphonostelic condition—here described for the first time, and apparently a direct demonstration of the point in question. (5) It has been shown recently that the meristematic areas at the growing point do not correspond to certain exact areas in the mature portion of the stem—thereby one of the arguments in support of opposing view is removed.

Polystely in the Orchidaceæ: J. H. WHITE, University of Toronto. (By invitation.)

Van Tieghem affirmed that the cauline steles of many plants repeatedly bifurcated, resulting in the phenomenon of polystely. He further affirmed polystely does not occur in roots, and that multistelic roots of many orchids result from the concrescence of monostelic roots.

His first statement has been disproved by Leclerc du Sablon, Jeffrey, etc.

The author of this paper takes up his second affirmation and shows that true polystely does exist in orchid roots, and that concrescence is not the correct explanation of the phenomena obtaining in them.

A large number of forms have been examined and conclusions have been based on the following facts: (1) The root apex is always covered by a single root cap, and at the tip a single primary dermatogen, periblem and plerome are to be found. (2) In some orchids the lateral roots are always monostelic. (3) In others they are monostelic at their base. (4) In the most complicated cases there are fewer steles at the base than farther out from the stem bifurcation of the steles is the rule. (5) The root initials consist of a single meristematic mass for each root, no indication of the concrescence of initials. (6) The ground tissue in mature roots show no signs of concrescence. (7) The roots in the youngest generations tend to be monostelic. An increasing complexity noted in succeeding generations. Certain forms examined lend support to the view that the medulla in some cases is of extrastelar homologies.

The Araucarieæ—A 'Proto-Siphonogamic' Method of Fertilization: ROBERT BOYD THOMSON, University of Toronto.

In my study of the megaspore membrane of the gymnosperms, supernumerary nuclei in the pollen tube of the Araucarieæ are referred to and the isolated position of the subgroup indicated. The ancient geological and the widely separated geographical distribution, the large microsporangiate cones in comparison with the megasporangiate, the evident transition between sporophylls and foliage leaves (points referred to recently by Professor Seward) are indications of an interesting and probably primitive group. The morphology and anatomy of the micro- and megasporophylls indicate that they are homologous structures, functionally differentiated. The microsporangium is fern-like. The microspore multicellular, and the pollen tubes

multinucleate (forty have been observed) as they grow in numbers over the sporophyll from their place of deposition, sometimes 3 cm. from the micropyle. Some penetrate the integument instead of entering the micropyle. There is no differentiation of a tube nucleus and only a single generative cell is present. For these reasons the Araucarieæ are considered by the author as proto-siphonogamic. There are indications also of a non-specialized embryogeny, intermediate in character between that of the cycads and of *Ginkgo*.

The Flowering Period of a Hybrid Opuntia: F. E. Lloyd, Desert Botanical Laboratory.

A Study of the Leaf-tip Blight of Dracæna fragrans: John L. Sheldon, West Virginia Agricultural Experiment Station. (Read by request before the Botanical Society of America.)

Tracy E. Hazen,
Secretary pro tempore

SCIENTIFIC BOOKS

Recherches expérimentales sur la Sexualité des spores chez les Mousses dioïques. Par El. et Em. Marchal. Mém. couronnés Cl. Sc. Ac. roy. Belgique, 2, I., 1906.

"A considerable number of plants are known in which a single egg gives rise by division to more than a single individual. Experimental investigations are demanded to determine if these individuals are always necessarily of the same sex." In response to this subject, thus recently proposed by the royal academy of Belgium, the Marchals have published the results of an interesting series of experiments on three dicœcious mosses, *Barbula unguiculata, Bryum argenteum* and *Ceratodon purpureus.* Sowings were made from individual sporangia of these three species and, in the mixed growth resulting, both male and female plants were obtained. The conclusion thus reached that the capsule in these species contains both male and female spores was confirmed by sowings from single spores. Of five spores from a single capsule of *Bryum argenteum,* three gave rise to protonemata producing male and two to those producing female plants. Similarly, of seven single-spore sowings from a capsule of *Barbula unguiculata,* three spores produced male and four produced female plants exclusively.

Secondary protonemata, obtained by regeneration from stem, leaf or pieces of protonemata, as well as by germination of gemmæ, were of the same sex as the plants from which they were derived.

Attempts to influence the sex of protonemata by subjecting them to different external conditions were entirely unsuccessful. The effects of the following factors were tested: (1) Illumination. Cultures in strong and in weak, diffuse daylight and under red and under orange-colored glass. (2) Temperature. Three grades of temperature from 10 to 27° C. (3) Humidity. Cultures in saturated atmosphere and in an atmosphere as dry as consistent with growth. (4) Nutrition. A clayey sandy soil watered with solutions of different chemical composition. The nutrition experiments would have been more satisfactory if a substratum had been used which alone was not capable of producing an abundant moss vegetation as was the sandy clay employed. The experiments are sufficient, however, to show that the gametophytes of the mosses tested are strictly dicœcious. Writers on the mosses have claimed that in dicœcious species both sexes arise from the same protonema, but heretofore no careful study of the sexual differentiation in the mosses has been undertaken. Marchal's important experiments illustrate the value and necessity of the cultural method of investigation.

These three species of mosses studied by Marchal and the liverwort *Marchantia polymorpha* investigated by the reviewer (*Bot. Gaz.,* XLII., 171, Sept., 1906) are the only dicœcious bryophytes for which the sexual character of the sporophyte is known. That these forms which are dicœcious in the gametophyte are all hermaphroditic in sporophyte (heterothallic and homophytic according to a more precise terminology [*Bot. Gaz., l. c.*]) does not prove that this is the universal type