and the action of the semi-permeable membrane, 12 pages. Three pages are devoted to references. Two figures appear in the text. The treatment does not claim to be exhaustive "so far as concerns work important in its time but now only of historical interest," the aim being to give special attention to recent investigations.

The amount of space devoted to thermodynamical considerations and the so-called theory of "ideal" solutions, together with the mode of treatment and what one reads between the lines, clearly shows the author's leanings. It is, however, quite safe to say that those who have actually spent their time in the laboratory at practical work with innumerable solutions and diverse osmotic membranes, entertain very little hope of a better understanding of solutions and osmosis from thermodynamical computations and mathematical equations of what are termed "ideal solutions." One might indeed about as well talk of an ideal chemical compound, an ideal plant, or an ideal animal, as of an ideal solution.

The monograph will doubtless prove useful to students of the subject of osmosis, especially because of the references to the recent literature, even though these be incomplete. It moreover also contains a good, clear exposition of the existing physical theories of osmosis and solutions. But in a publication of this kind, which is especially intended for students, one has a right to expect something that will inspire and spur the student on to further experimental inquiry in the subject. In this respect, however, the monograph is sadly lacking, and how can it be otherwise, for to those that seek to solve the problem by thermodynamics and theories of "ideal solutions" new experiments along specific lines naturally do not suggest themselves, for they are really not required for the purpose of the explanation. A theory of "ideal solutions" suggests chiefly how known facts can be harmonized with it and how the "troublesome exceptions" may be accounted for; it does not suggest how new fields may be opened up. To those that thus vainly hope to solve the practical problems of solutions and osmosis particularly as they relate to organic beings, one may well quote the immortal words of Goethe, "Grau teurer Freund ist alle Theorie und grün des Lebens goldener Baum."

LOUIS KAHLENBERG

THE BOTANICAL SOCIETY OF AMERICA

THE eighth annual meeting of the Botanical Society of America was held in the State Capitol Building, at Atlanta, Georgia, December 30, 1913, to January 1, 1914, about ninety members being present. The following officers were elected:

President—A. S. Hitchcock, U. S. Department of Agriculture.

Vice-president—B. M. Duggar, Missouri Botanical Garden.

Councilor—D. G. Fairchild, U. S. Department of Agriculture.

One hundred and thirty new members were elected to the society.

The report from the committee on the new journal was adopted. This provides for a cooperative arrangement with the Brooklyn Botanic Garden which will make possible the immediate publication of the journal and the first number of the *American Journal of Botany* will appear during January. All members of the society become contributing subscribers to the *Journal*, the price being fixed at $3.00 annually to members and $4.00 to non-members. Attention is called to the fact that candidates for membership (meaning those whose applications were received too late for action or those who may apply for membership during the year) may, upon approval of the council, receive the journal at the same rate as members.

The address of retiring President L. R. Jones on "Problems and Progress in Plant Pathology," together with the symposium on "Temperature Effects," participated in by Dr. Frederick Barry, Dr. B. M. Duggar, Dr. D. T. MacDougal and Dr. Forrest Shreve, will probably be published in the new journal of the society.

The dinner for all botanists was held New Year's night, the topic for discussion being the new journal.

Following are abstracts of the papers presented at the general sessions and at the newly organized physiological section:

The Seasonal Life History of Some Red Algæ: I. F. LEWIS.

Experiments were performed at Woods Hole dur-

ing 1911, 1912 and 1913 on the following species: *Griffithsia Bornetiana, Dasya elegans* and *Polysiphonia violacea.* Tetraspores and carpospores were planted on oyster shells, which were then fastened to piles and left during the winter. The annual life cycle of the species studied runs as follows:

In June young plants become visible. These produce, for the most part, tetraspores, though an occasional sexual plant may be found. The tetraspores are released in July and germinate immediately to form the second crop, which consists of sexual individuals. These often occur on other algæ and *Zostera,* whereas the first crop of tetrasporic individuals is confined to stones, piles and other objects of a more or less permanent nature. The sexual crop releases its carpospores in August or early September. It is the small sporelings from these spores which winter over. The individuals which have attained any considerable size all die at the approach of cold weather. The tiny holdfasts of the very young sporelings may be seen during the winter and spring. From them arise the tetrasporic plants of the first summer generation.

The alternation of generations in these species is thus connected with their seasonal occurrence. The sexual generation is characteristic of late summer, while the tetrasporic plants survive the winter and predominate in early summer.

There is no sharp line between the first and second crops, as a small percentage of both occur out of season. This is particularly true of the tetrasporic individuals, which under favorable conditions may survive throughout the summer and continue to produce spores up to September. A few of these belated tetraspores form holdfasts which winter over and produce the scarce sexual plants of the early summer following. In general, however, the two crops are well marked.

The Marine Algæ of Peru: Marshall A. Howe.

The specimens on which, chiefly, the paper was based were secured by Dr. Robert E. Coker, now of the U. S. Bureau of Fisheries, while acting as fishery expert for the government of Peru during the years 1907 and 1908. They are referable to about 100 species and they constitute one of the largest collections of algæ thus far made in South America and by far the best ever brought from Peru. For the satisfactory determination of the specimens it has been necessary to examine the original materials of a considerable number of little-known and briefly described South American species. The algæ of Peru has been sparingly collected, especially during a period of seventy-five years preceding Dr. Coker's visit, and about one third of the species found by Dr. Coker appear to be undescribed. Although Peru lies wholly within the tropics, its marine flora, with the exception of a strip of coast about twenty miles long at the extreme north, is of a temperate rather than a tropical character. This is apparently due to the influence of the Humboldt or Peruvian Current, which brings northward the cold waters of the South Temperate and Antarctic regions. The mean summer temperature of the ocean at Callao, latitude 12° South, is said to correspond to that of New York, latitude 41° N., and of Monterey, California, latitude 36° N. Accordingly, one finds the typically tropical genera of green and red algæ poorly or not at all represented on the coast of Peru. Instead, the larger brown algæ, species of *Macrocystis, Lessonia* and *Eisenia,* are the dominating elements in the marine flora.

Lantern photographs were exhibited, showing some of the more characteristic species of the region. Among these were several illustrating the hapteres and the disposition of the sporangia in various forms of *Macrocystis.*

The Trend and Influence of Certain Phases of Taxonomy: Aven Nelson.

Taxonomy has its place. It trains the perceptive faculties, teaches orderliness, develops judgment and strengthens reason. There is a saving grace in botany not found in most of the other sciences and this is exercised through taxonomy more fully than through all the other divisions of botany combined.

Systematic botany furnishes to the average layman a more continuous incentive for pleasurable and inspiring contact with the world about him than any other subject that lays claim to a place in a cultural course. It may be the primitive phase, but most great botanists at least began at this point, thus illustrating in their development the recapitulation theory.

Systematists were never so numerous nor more active than at present. All activity is not necessarily progress. Motion up and down may be spectacular and nothing more.

There is but one reason for the existence of the professional systematist; viz., to make it easier for others to know plants. If we fail in this one thing we fail in all. Judging by the indifference of the multitude to our work; by the hopelessness of the amateur who tries to acquaint himself with

the plants he meets; by the none-too-well concealed cynicism of our colleagues in other lines, we are failing in this. Our work has been analytic, not constructive. We have dismembered organisms and held up to view their component parts. We have been looking for differences, and with such amazing success that the fundamental resemblances have, for the most part, escaped our notice.

Morphology, physiology, ecology and economic botany in its scores of applications have all gone forward by leaps and bounds, but in spite of, not by the aid of, taxonomy. Not all taxonomic work has been useless or erroneous. Keenness of observation and great powers of discrimination are not lacking. It is not so much that what has been should not have been done, but rather that more should have been done to relate recent work to that which has gone before. Synthesis should have followed so closely upon the analysis of the elements of our flora that duplications would promptly have been discovered and the relation of each element to the other detected and stated.

We are on the eve of a new era of reconstruction. Already the pendulum is swinging back toward greater conservatism. The dismemberment of genera and the multiplication of species proceed more cautiously. This grows out of the revitalized aim, "make it easier for others to know plants."

Studies of Teratological Phenomena in Their Relation to Evolution and the Problems of Heredity: I. *A Study of Certain Floral Abnormalities in Nicotiana and Its Bearing on Theories of Dominance:* ORLAND E. WHITE.

Nicotiana plants showing petalody were selfed and progeny grown from them. In one race the abnormal character was extremely variable, some plants showing a large expression, other plants showing it only to a slight degree. This race varied in many other characters, proving the mother plant to have been very heterozygous. In another race, the abnormality was reproduced in all the progeny to the same degree as in the mother plant. With the exception of pollen color, no variation in other characters occurred in this race, indicating that it was largely homozygous in its hereditary constitution.

Pistillody originated as a discontinuous variation and was inherited in the same manner, crosses with the normal in one case giving in F_2 a progeny closely approximating a simple 3:1 ratio. In two hybrid F_1 families, it was completely recessive, while in what appears to be another hybrid F_1 family, it is wholly dominant. The first two families differ from the last family in a large number of characters, as the ancestry of the latter involves another species.

The catacorolla race of *Nicotiana* originated through a discontinuous variation. When crossed with normal races, the F_1 progeny were either intermediate in character or absolutely normal, though the individual F_1 progeny from each cross showed no variation among themselves. Great variation existed between the different pollen parents of many of these F_1 individuals.

As a whole, the data secured from hybridizing races of normal plants with those possessing the three abnormalities discussed above support the view that dominance and recessiveness are not in any way attributes of the factor or "character" in itself, but are the result of the factor expression plus the modifying influence of the environment, whether genotypical (all the other genetic factors of the organism not primarily concerned in the transmission of a particular character) or external (soil, climate, etc.). The variability of the catacorolla expression in the 119 F_1 plants of ($-4-1A \times 119$ normals) is striking supporting evidence that this conception of dominance is the most tenable of those recently advanced by genetics.

Observations on the Behavior of Some Species on the Edges of their Ranges: ROBERT F. GRIGGS.

In the Sugar Grove region of central Ohio about 125 species, 13 per cent. of the native flora, reach their territorial limits. These plants are of diverse geographical affinity stretching away in every direction. More than half are abundant in many stations; only $\frac{1}{10}$ are rare; 21 are outliers far from their next station; 27 range continuously up to their limits; 77 reproduce well; only 18 reproduce poorly. The success of the seedlings in meeting plant competition is apparently more important than success of the reproductive apparatus. The theory that plants are confined to their optimum habitats at their termini does not accord with observation. On the contrary, some plants occupy the most unfavorable habitats, being forced by competition to grow where they can find room. The causes of the termination of these ranges is not evident. Climatic adaptability is evidently the limiting factor restricting the spread of species, but there does not appear to be such a climatic adjustment in the present instance, for most of these termini appear not to be stable, but are either advancing or retreating. There are tension zones between the different spe-

cies similar to the tension zones between ecological associations. By observation of these geographical tension zones it is possible to detect the trend of geographical movements. The indications at Sugar Grove are that Boreal types are giving way to others from the west and south. (To be published in the *Bulletin of the Torrey Botanical Club*, January, 1914.)

Variations in Iowa Oaks: B. SHIMEK.

Iowa occupies a peculiarly favorable position for the study of variations in oaks. Here northern, southern and eastern forms meet, and many of them appear in groves bordering the prairies.

Perhaps because of this, great variation is exhibited by many plants, those of the oaks being among the most striking and interesting.

The paper deals especially with variations in leaves and acorns, though other characters receive attention. Seventeen species and varieties are reported from the state, but chief emphasis is placed on variations in *Quercus macrocarpa, Q. alba,* the *Q. acuminata* group, *Q. rubra* and the *Q. coccinea* and *Q. velutina* group. The difficulty in determining species is considered and the value of specific characters is discussed, and special attention is given to the discussion of such disputed species as *Quercus coccinea, Q. ellipsoidalis, Q. boreale, Q. velutina, Q. texana* and *Q. Schneckii.*

The distribution of some of the species is discussed, and the record of the range of distribution of several species is corrected.

Segregation of Characters in First Generation Hybrids from Stable Species of Œnothera: GEO. F. ATKINSON.

The parents are stable wild species of Œnothera (*Œ. nutans* Atkinson & Bartlett, and *Œ. pycnocarpa* Atkinson & Bartlett),[1] found growing in the vicinity of Ithaca, N. Y. They have been cultivated through two generations. They differ in 25 to 30 clearly observable characters (a close analysis will reveal more) distributed in rosettes, stems, stem leaves, bracts, flowers, habit and propagation. Reciprocal crosses give rise to hybrids which show segregation of characters in the first generation. A number of the characters are contrast characters and behave as unit characters in segregation into twin and tripled first-generation hybrids.

Isomorphism in Capsella Hybrids: HENRI HUS.

In an earlier paper, presented at the Cleveland meeting, the presence of a gene *N*, to which the narrow character of the earlier leaves is due, was demonstrated for *Capsella Bursa pastoris Setchelli.* This form was shown also to contain Shull's gene *B*, responsible for the deeply incised primary lobes, as well as for the presence of secondary lobes. At the time it was thought that in the F_1 generation of a plant of the partial zygotic constitution *BbNn*, the combination *BN* was not formed (gametic repulsion). Experiments carried on during 1913 have demonstrated that this combination does exist and also that, whenever a plant is homozygotic for *N*, the identical external appearance obtains, independent of whether the remainder of the ascertained zygotic constitution is *BB, Bb* or *bb*. Such combinations always yield the form *arachnoidea.*

On Physiological Isolation in Types of the Genus Xanthium: CHARLES A. SHULL.

Remarkable variations in the burs of what has been considered *Xanthium canadense* Mill. have been noticed in Kentucky, in Kansas and elsewhere during the last several years. Three distinct types were selected in the fall of 1912 from the local flora where all were growing together on the same soil under identical conditions, for breeding experiments. These types have bred true to the parental generation, notwithstanding their close proximity in the field and their unguarded pollination. Differences were noticed in the burs, seeds, leaves, pigmentation, etc., and in the length of time required for the development of the reproductive organs. Because they bloom at different ages the types tend to remain distinct, although there is evidence that occasional hybrids may occur under natural conditions. The genus needs revision based upon experimental investigation.

On an Abnormality in the Flower of the Bellwort (Oakesia sessilifolia) which Prevents Seed Formation: A. F. BLAKESLEE and A. F. SCHULZE.

The abnormality consists in transformation of stigmas into anthers containing pollen grains which in sugar solutions germinate, as well as pollen from the normal stamens of the flower. Such abnormal flowers do not set seed.

Variability in a Vegetatively Pure Line of a Hermaphroditic Mucor: A. F. BLAKESLEE.

Separation cultures from a single spore sowing of the mucor tested gave a small percentage of colonies sharply different from the stock form. The variations consisted in absence and increase or decrease of zygospore production, peculiarities in color, density and rapidity of mycelial growth, differences in height of mycelial filaments, the almost exclusive production of yeast-like cells in

[1] See *Rhodora,* 15: 83–85, 1913.

place of a filamentous mycelium, the production of a filamentous mycelial growth devoid of sporangia, and a partial change at least toward the dioecious condition. Some of these variants are surely temporary conditions for they tend eventually to revert to the normal type. Others may be more permanent but have not been sufficiently investigated. All, however, tend partially at least to reproduce the new characters and some have for several sporangial generations kept their peculiarities in gross cultures during the few months it has been possible to propagate them. Many of them would undoubtedly be described as distinct species by specialists in the group.

The Development of Amanitopsis vaginata and Lepiota clypeolaria: GEO. F. ATKINSON.

Amanitopsis vaginata.—The primordium of the pileus arises in the middle of the upper part of the young carpophore as a dome-shaped area. This soon differentiates into an upper portion, the pileus primordium; and a lower one, the hymenophore primordium. By surface and marginal growth (the latter being epinastic) through the enveloping fundamental tissue, the pileus is formed. By downward and obliquely inward growth of the hymenophore through the fundamental tissue toward the stem fundament the primordial tissue of the lamellæ is formed. This gradually becomes differentiated into the primordia of the lamellæ, the trama of the gills being continuous with the trama of the pileus and the surface of the stem. There is no internal annular gill cavity as in *Agaricus, Lepiota,* etc. The fundamental tissue enveloping the primordia of pileus, hymenophore and stem is the "universal veil," or in fact gives rise to it at a quite late period in the organization of the pileus when an outer zone of the developing pileus changes into a gelatinous cleavage layer.

Lepiota clypeolaria.—Before any evidence of internal differentiation of the primordia of the pileus, hymenophore and stem, the young carpophore presents an outer duplex zone, the "universal veil" of Fries. The inner portion of this zone consists of a thin layer of subpseudoparenchymatous cells, the outer portion of long radially extending threads. After the origin of the stem and pileus fundaments, this "universal veil" is for some time separated from the pileus and stem by a zone of loose fundamental tissue. In the further differentiation of the pileus the surface threads grow through this intermediate zone of fundamental tissue and tie into the inner zone of the "universal veil" so that the latter becomes "concrete with the surface of the pileus," no cleavage layer being formed.

A Preliminary Note on Spore-formation in Cyathus: GUY BISBY.

Practically no work has been done in recent years on this genus, making an examination of some interest. The nuclear divisions in the basidium is followed in *Cyathus vernicosus* by a nuclear division in the spore, making this species binucleated, whereas in *Cyathus stercoreus* the spores remain uninucleated. This cytological feature should be of advantage as a systematic criterion. Hyphæ growing from germinated spores have been observed, in forming anastomoses, to be met by a short protuberance from the hyphæ approached, apparently responding to some sort of attraction.

Variation in the Sporangia and Spores in the Saprolegniaceæ and its Bearing on their Classification: W. C. COKER.

Original observations on such variations are reported and the literature examined. It is concluded that while there is great variation in size, arrangement and behavior of both spores and sporangia, these (with possibly a single exception) are not of a character to confuse our present conception of genera in this family.

A Peculiar Water Mold: W. C. COKER.

A new species is reported from Chapel Hill, N. C., that exhibits in a confusing way certain of the reproductive peculiarities of *Achlya* and *Saprolegnia.* The spores on emerging swim away in part while others remain attached to the sporangium tip.

Occurrence and Periodicity of Water Molds at Chapel Hill, N. C.: W. C. COKER.

The results of about 450 collections are given, showing the relative abundance of the species found and their periodicity in so far as it exists. About 20 species are discussed.

Foliage Resistance of Different Varieties of Potatoes to Phytophthora infestans: I. E. MELHUS.

A study has been made of the varietal resistance of potatoes to *Phytophthora infestans* by artificially infecting the foliage. Varieties reputed to be either resistant or susceptible were grown in the greenhouse and subjected to favorable conditions for *Phytophthora* infection. The conidia of the fungus were germinated in water at optimum temperature conditions (about 13° C.). The resulting zoospore suspension was sprayed in the lower surface of the leaves of the healthy,

vigorous plants from 6 to 12 inches tall. Plants thus treated were held in a moist atmosphere at 20° to 25° C. over night and removed the following morning.

It is believed that by this method it is possible to learn the relative resistance of any variety without growing it under field conditions.

Plus and Minus Strains in the Genus Glomerella: C. W. Edgerton.

Cultures of *Glomerella* from different hosts have been obtained which show the presence of two different strains, these being provisionally called plus and minus strains. The plus strain produces normal perithecia in clumps or masses. The minus strain produces perithecia, usually immature, scattered profusely over the surface of the culture medium. When these two strains are placed in the same plate and allowed to grow together, a dense black ridge of normal perithecia develops on the boundary line. The two strains of one of these fungi have been carried for over three years and are still producing perithecia abundantly. That there is a fertilization between the two strains has been proven by isolating single asci from the boundary line between the two strains and allowing them to grow into colonies. These colonies usually produce both strains.

The Homology Between Spore-forms in the Ascomycetes: C. R. Orton.

It has been pointed out in the rusts that there is a very striking morphological similarity between certain heteroecious species. This morphological likeness may be termed homology. It is pointed out in this paper that a similar homology exists between the conidial and ascigerous stages of certain Ascomycetes with respect to morphology of their spores. Examples are cited and discussed which show the likeness as well as the apparent exceptions. It is hoped that this fact may be of value to the mycologist and plant pathologist as a guide to life-history studies.

A Contribution to the Life History and Physiology of Cylindrosporium on Stone Fruits: B. B. Higgins.

A careful study of the life history of this parasite has brought to light a very interesting polymorphism. Four spore forms were found to be genetically connected in the life cycle as follows: Typical *Cylindrosporium conidia,* produced on delicate stromata in spring and summer; microconidia, produced on the same stromata in late fall; ascospores, produced in apothecia in the dead leaves during the following spring; and apothecial conidia, produced later in the same apothecia following the discharge of the ascospores. All of these except the microconidia are capable of producing infection on the host plants.

A study of the morphological and biological characters of the organism from eight species of *Prunus* showed that the forms under consideration fall naturally into three species, one on each of three more or less distinct divisions of the host genus.

North American Species of Peridermium on Pine: J. C. Arthur and F. D. Kern.

The authors published a paper covering this ground in 1896, since which time much information has been added to previous knowledge, which the authors now propose to summarize. Some of the former names have been reduced to synonymy, chiefly as the result of culture work, and two new species are established, one from California and one from Guatemala. Some three or four species have been introduced from Europe, and are yet local. Doubtless the greatest economic interest centers about the caulicolous forms, native and foreign, and these have been discussed with considerable fulness.

Transpiration of Silphium laciniatum L.: L. A. Giddings.

The experiments discussed in the present paper were carried on with *Silphium laciniatum* L. This plant was selected for experimental purposes because of the fact that it is a xerophyte growing in very dry exposed prairie regions and because, being taller than most of our native prairie plants, it offers opportunities for the study of normal transpiration in relation to evaporation at different altitudes above the surface of the soil.

The paper includes a discussion of the experiments carried on in the laboratory and in the field. A part of the experiments were carried on in the plant physiology laboratory of the State University of Iowa. The field experiments were carried on at the Macbride Lakeside Laboratory on West Lake Okoboji during the summer of 1912. Material for the study of the structure of the leaf was collected at the same time that the field experiments were being performed.

In the laboratory special attention was given to the effect of increased wind velocity on the rate of transpiration. Evaporation experiments were run with the transpiration experiments for comparison. In the field experiments attention was also given to the effect of wind velocity on

the rate of transpiration, but in these experiments relative humidity was also carefully studied and a comparison between the time of day when the lowest relative humidity occurred and the time of day when evaporation and transpiration were greatest. The rate of transpiration of leaves taken at different heights was studied, together with evaporation at the same heights.

The laboratory experiments showed that the rate of transpiration increased with wind velocity up to a certain limit, after which it did not increase in proportion to the increase in wind velocity. As a rule, in the field experiments transpiration was greatest before evaporation had reached a maximum.

The Effect of Certain Surface Films and Powders on the Rate of Transpiration: B. M. DUGGAR and J. S. COOLEY.

It is commonly observed that leaves of plants sprayed repeatedly with Bordeaux mixture may remain green and healthy, towards the close of the season, several weeks after unsprayed leaves free from fungous diseases have ripened. The experimental work reported up to this time has afforded no data indicating differences of sufficient magnitude between the activities and unsprayed leaves to account for the extended vegetative period. The experiments here reported were made for considerable periods of time with standardized castor bean leaves in potometers and with large numbers of potted tomato plants. Bordeaux mixture, aluminium mixture, lime, and certain other film-forming liquid and powders were employed. In every case the rate of transpiration was higher in the Bordeaux sprayed plants than in the controls, or as compared with the standard. The important differences make it necessary to give weight to increased transpiration in any explanation offered.

The Relation Between the Transpiration Stream and the Absorption of Salts: HEINRICH HASSELBRING.

During the winter of 1908–1909 experiments were conducted at Santiago de las Vegas, Cuba, in order to determine the comparative transpiration of tobacco plants under cheese-cloth shade and in the open ground. For this purpose plants were grown in galvanized iron tanks which were set into outer encasing tanks permanently sunk in the ground. Six tanks were placed among the plants of a field of tobacco grown under cheese-cloth, and six were set in an adjoining tobacco field not shaded. The quantity of water transpired by the plants in the tanks was determined by daily weighings, the quantity transpired being replaced each day. At maturity the leaves, stems and roots of each plant were harvested separately, dried and ground. The ash was determined in water-free samples of the ground material. From the data the total ash of the plants was calculated.

The plants grown in the open absorbed about 28 per cent. more water than those grown under shade. The plants which absorbed and transpired the greater quantity of water contained both the smaller percentage and the smaller absolute quantity of ash.

It appears, therefore, that the absorption of salts by roots is independent of the absorption of water, and that the transpiration stream does not exert an accelerating effect on the entrance of salts.

Relation of Transpiration of White Pine Seedlings to Evaporation from Atmometers: G. P. BURNS.

An attempt was made to express the data recorded by meteorological instruments in terms of plant physiology and thus give them a botanical significance. The experiments were conducted in the state forest nursery under different degrees of "shade."

A comparison of the water loss from white and black atmometers with that from white pine seedlings under three conditions of shade used gave the following coefficient of transpiration:

Half shade	.0088 for black atmometer.
	.0087 for white atmometer.
No shade	.062 for black atmometer.
	.084 for white atmometer.
Full shade	.036 for black atmometer.
	.044 for white atmometer.

By use of these coefficients it is possible to calculate the water loss from white pine seedlings from the evaporation from the atmometers.

Half shade reduces the transpiration and the evaporation, but the graphs show that the response of the plants and the atmometers is not identical. The decrease in water loss due to "shade" for the first part of August, 1913, was as follows: black atmometer 50 per cent., white atmometer 44 per cent., white pine seedling 70 per cent.

Plants grown under the three conditions studied showed great variation in structure, in the amount of ash, and their chemical composition. The amount of water transpired by the no-shade plants was many times that transpired by the

plants in half and full shade, but the per cent. of ash, figured on a dry matter basis, is less in these plants than in either of the other two sets of plants.

Relative Transpiration in Rain-forest and Desert Plants: Forrest Shreve.

Relative transpiration is defined as the ratio of the absolute transpiration of a unit area of leaf surface to the concurrent evaporation from a unit area of water. Its values give an index of the physiological controls of transpiration and of the action of light upon it. Relative transpiration and stomatal movement have been studied in several Jamaican rain-forest plants, with the general result that the two do not show a sufficiently close correlation to warrant the view that either is wholly controlled by the other.

A comparison of the rates of relative transpiration in rain-forest and desert plants shows them to be of the same order of magnitude in the two groups, as investigated under the conditions of their native environments, in Jamaica and in Arizona. Since the annual evaporation total in Arizona is ten times that in Jamaica, it follows that the absolute transpiration per unit area in plants of the desert is approximately ten times as great as it is in the rain-forest.

Seasonal Variations of the Osmotic Pressure of Pool, Pond and Stream Waters: Edgar N. Transeau.

Freezing-point determinations of the osmotic pressure of the natural waters of pools, ponds and small streams in central Illinois, made at intervals during the year 1913, have shown the following general results:

1. The osmotic pressure, expressed in millimeters of mercury, varied from 59 to 407.

2. The highest pressures were recorded during early spring when the water levels were highest.

3. The lowest records were made during the middle of September when the levels for the year were lowest.

4. Contrary to the statements often made, when the water level of ponds and pools lowers in late spring and summer, the osmotic pressure of the water is not increased, but is often greatly diminished.

5. When streams are reduced to pools, the water may have a higher pressure; as the pools dry up the pressure is diminished.

6. There are sudden and considerable variations in the pressure, sometimes coincident with weather changes, development or decay of algæ, etc., but sometimes without apparent connection with other known factors.

The year 1913 was an exceptionally favorable one for testing the relation between lowering water levels and concentration, as there were no rains of consequence between the middle of April and the middle of September.

Zoospore Formation in Characium acuminatum: Gilbert Morgan Smith.

The mature plant is multinucleate and contains 16, 32 or 64 nuclei at the time that zoospore formation takes place. In the growth of the alga the nuclear divisions are mitotic and all nuclei divide simultaneously. There may be more than one pyrenoid present and the shape of the pyrenoid is quite irregular. Very thin starch plates are found around the pyrenoid, while other plates of stroma starch, probably derived from the pyrenoid, are found scattered throughout the cytoplasm.

The zoospores are formed by progressive cleavage. Cleavage takes place by a furrowing in of the plasma membrane. The first cleavage furrows are transverse and then longitudinal cleavage furrows cut the protoplasm into multinucleate masses. These multinucleate masses are then cut into angular uninucleate protoplasts by further cleavage. There is no division of the pyrenoid, but it remains unchanged till cleavage has been completed, when it disappears. The angular uninucleate protoplasts then become ovoid and a pyrenoid is formed *de novo* in each one. These are the zoospores which are liberated by the rupture of the old mother cell wall.

A Preliminary Report on the Isolation and Identification of the Enzymes of Fucus vesiculosus: B. M. Duggar and A. R. Davis.

Peculiarities in the carbohydrate and nitrogen metabolism of the Fucaceæ make desirable a determination of the enzyme content of the growing tissues. Employing a variety of methods, no evidence has yet been found to indicate the presence of any of the commoner carbohydrases except cellulase. The commoner esterases are likewise absent, but amidases are well represented. Urea, especially, is rapidly transformed and urease is apparently widely distributed in the tissues. Oxidases have not been detected by any of the usual methods.

Relation of Certain Grass-Green Algæ to Elementary Nitrogen: Jacob R. Schramm.

The number of species of algæ in which free nitrogen fixation has been investigated under pure cultural conditions is relatively small—represent-

ing not more than four or five genera. By a pure culture here is understood one containing a single species of alga free from all other organisms. What work has been done with pure cultures has led invariably to the conclusion that these forms are unable to fix free atmospheric nitrogen both in the presence of and absence of combined nitrogen and energy-furnishing materials. It is by no means certain, however, that forms do not exist which under one or all of these conditions are able to utilize elementary nitrogen. This thought is especially justified when the small number of free nitrogen-fixing species among the bacteria are considered.

By a variety of methods approximately 25 species were isolated in pure culture. Of these, two were blue-greens, 2 diatoms, and the remainder grass-greens. Seven species of the latter were tested for free nitrogen fixation in the complete absence of combined nitrogen. The effect of a slightly elevated temperature was determined in a duplicate series maintained at a temperature of from 29.5 to 30.5° C.

No fixation was observed in any of the species and, unlike certain fungi, no favorable effect was exercised by the higher temperature.

Indications Respecting the Source of Combined Nitrogen Used by Ulva lactuca: G. L. FOSTER.

Laboratory cultures of *Ulva lactuca* in sea-water showed increased growth over that of the controls, when ammonium nitrate, urea or acetanide was added. Na-asparaginate did not increase the growth. Dimethylanilin and acetanilide were extremely toxic.

Parallel experiments in which the same compounds were added to artificial sea-water less nitrogen, gave similar results.

The Influence of Etherization on Certain Enzymatic Activities of Bulbs and Tubers: M. M. MCCOOL.

The experiments reported deal chiefly with the relative activity of diastases, oxidases and catalase in etherized and natural bulbs and tubers. Material from the two sources indicated differ materially in the activity of the enzymes. Diastatic action is greater in the etherized tissues; and this is also true for the action of oxidases and peroxidases. Catalase activity is, however, diminished by etherization.

On the Tracheary Origin of the Resin Tissue of the Conifers with Special Reference to Abies balsamea: R. B. THOMSON.

After a careful survey of the resin tissue in the whole Conifer series, the conclusion has been reached that the ligneous resin tissue of the Conifers owes its origin to the modification of tracheary elements. This seems self-evident when it is considered that the Cordaitean forms, from which the Conifers are generally conceded to have arisen, have wood which is wholly tracheary. This view is directly opposed to that of Penhallow, who regards the resin tissue as derived from parenchyma, a view which is no doubt responsible for the recent theory of Kirsch that the vertical resin canals of the pines are proliferated from the *parenchyma* of the medullary rays.

In *Abies* Penhallow found transitions between the parenchymatous cells of the resin cysts and parenchyma-shaped tracheary elements. These he interpreted as evidence of the transformation of parenchyma into tracheary elements, whereas the writer presents evidence to show that both these and the parenchyma elements are derivatives of tracheids, the chief point being that these elements or combinations of them and the parenchymatous ones are *in vertical series coterminous* and *in the same radial sequence with ordinary tracheids.* They are thus derived from the same cambial cell which ordinarily gives rise to a tracheid. The modification occurs in association with the medullary rays, which are the only source of preservative in the most ancient fossil woods.

Cycad Pitting: H. B. SIFTON.

The pits on different parts of individual tracheids of the Cycads differ. The terminal ones, and those on the sides touching parenchyma tissue are more primitive than the others. In arrangement the pits are opposite or alternate indiscriminately, and are even quite commonly scattered or in small groups of two or three, facts which show that the arrangement of pits is not a feature of so great phylogenetic importance as has been thought. In cases of scattered or group pitting, there is present a probable precursor or primitive form of the "bars" or "rims" of Sanio, structures which have not been previously described in the Cycads, the only group of living Gymnosperms in which they have not been found.

A reexamination of type material of *Cordaites missouriense* (*C. illinoisense*) reveal several important features not mentioned in Penhallow's brief description.

The pitting is more primitive near the ends of the tracheids, and beside the medullary rays, than on other parts. This is shown by an increase in the number of rows of pits, and by the greater

dimensions of the pores. As many as six rows may be found where the tracheid touches the ray cell, and here the pores may extend considerably beyond the border of the pits. Again, in arrangement, the pits, though usually alternate, may be opposite, and are often scattered.

One remarkable feature is that many tracheids have bent ends, usually at the rays. These bent ends reach over several tracheids, and thus afford a means for radial conduction. Such tracheids have long been known in the Araucarineæ and are considered to be ancestral to true ray tracheids. They are for the first time described in a Cordaitean form.

Trabeculæ are present in many tracheids; a feature which has not been noted previously among Cordaitean forms. Peculiar wandering parenchymatous cells are also found associated with the medullary rays.

Tyloses: A Study of Their Occurrence and Practical Significance in Some American Woods: ELOISE GERRY.

In this study of the occurrence of tyloses in wood from trees of commercial size grown in the United States, 203 specimens were examined. The 143 specimens of hardwoods include 94 species belonging to 45 genera, 24 of which contained tyloses. The 60 specimens of conifers included 45 species belonging to 13 genera, 1 of which contained tyloses. Of the total 139 species examined, 56 belonging to 25 genera[2] contained tyloses.

Tyloses were found in the sapwood of all the species where their presence was established in the heartwood.

Well-developed tyloses were found in the outermost rings near the bark of 30 species of hardwoods.

True tyloses occur in the wood tracheids of certain pines, principally of the white pine group.

Epithelial cells sometimes effect a partial or even a complete tylose-like closing of the resin canals in *Pinus, Larix, Picea* and *Pseudotsuga.*

A considerable proportion of the vertical canals, even in the heartwood of the pines, are wholly or partly open.

Tyloses act like a natural filler in the hardwoods.

The woods where tyloses are abundant are, as a rule, durable.

[2] *Æsculus, Fagus, Liquidambar, Liriodendron, Magnolia, Oxydendrum, Platanus, Populus, Salix, Castanea, Catalpa, Celtis, Chilopsis, Eucalyptus, Fraxinus, Hicoria, Juglans, Morus, Quercus, Rhus, Robinia, Sassafras, Toxylon, Ulmus, Pinus.*

Tyloses, because they are very impermeable to air, water and creosote, reduce the penetrance of the woods in which they are strongly developed, thus decreasing, for instance, the tendency for such woods to become water-logged.

The presence of tyloses closing the vessels of a hardwood does not, however, prevent the penetrance of a preservative such as creosote into the other wood elements.

(*To be concluded*)

GEORGE T. MOORE,
Secretary

SOCIETIES AND ACADEMIES

THE TENNESSEE ACADEMY OF SCIENCE

THE annual meeting of the Tennessee Academy of Science was held in Furman Hall, Vanderbilt University, Nashville, Tenn., on November 28, 1913. President Watson Selvage delivered an address relative to the aims and purposes of the Academy, and the following papers were read and discussed:

"A Natural Bridge of Tennessee in Process of Formation," by H. D. Miser.

"Physiographic Features of Tennessee," by L. C. Glenn.

"Development of the Phosphate Industry in Tennessee," by Lucius P. Brown.

"Caverns and Rock Shelters of the Cumberland Valley," by W. E. Myer.

"Food Preservation," by L. C. Bliss.

"A New Geological Map of Tennessee," by A. H. Purdue.

"Some Neglected Principles of Physiography," by A. H. Purdue.

"Some Early Topographic Maps," by L. C. Glenn.

The following officers were elected for the ensuing year:

President—L. C. Glenn, Vanderbilt University, Nashville.

Vice-president—W. E. Myer, Carthage.

Secretary—Roscoe Nunn, 1235 Stahlman Building, Nashville.

Treasurer—Archibald Belcher, Middle Tennessee Normal School, Murfreesboro.

Editor—James A. Lyon, Southwestern Presbyterian University, Clarksville.

The president appointed as members of the executive committee, S. M. Bain, University of Tennessee, Knoxville, and E. J. McCroskey, Lebanon.

ROSCOE NUNN,
Secretary