tem of conics corresponding to it in the manner above explained, the secondary system. It is shown that the equation of a conic of the secondary system is of the fourth degree with respect to the parameter and that, therefore, four conics of the secondary system pass through any particular point in the plane.

The equation of the radical axis of two circles, μ and μ', of the system is

$$y = \frac{F}{G} x + \frac{H}{G},$$

F and H being of the fourth degree in μ and μ' and G of the third degree. It thus appears that there are sixteen sets of values of μ and μ' for which this equation represents the same radical axis; that is, there are sixteen pairs of circles having the same radical axis. Moreover, to these thirty-two circles there correspond thirty-two conics of the secondary system, all of which are tangent to the same radical axis.

The paper includes, by way of introduction, a brief discussion of the equation

$$\mu^2 P + L\mu Q + MR = 0.$$

A New Type of Transit-Room Shutter: Professor DAVID TODD, Amherst, Massachusetts.

The type of shutter here described is that used to cover the two transit slits of the new observatory of Amherst College. These slits have a clear opening of 100° each way from the zenith and are three and one half feet in width. Each shutter is twenty-one feet long and sixteen feet high. It is made of structural steel with two vertical members and one truss member across the roof. Its weight is about three thousand pounds.

The entire shutter moves as a unit upon ball-bearing rollers underneath the vertical members. These rollers travel upon rails lying east and west along the north and south walls of the building. The two ends of the shutter are made to travel in unison by means of rack and pinions with sprocket wheels and link-belt chain.

The roof-member travels ten inches above the roof of the transit room, thus clearing all ordinary depths of snow. Only the bottom of this member is covered in, the structural elements of its top and sides being left exposed as in bridge work. Wind thrust is thereby minimized.

The entire shutter opens or closes full width in four seconds, by eight turns of a hand wheel. A small shaft lock holds it firmly in either position.

LAENAS GIFFORD WELD,
Secretary.

SECTION G, BOTANY.

SECTION G at the St. Louis meeting was organized, under the chairmanship of Professor T. H. Macbride, on December 28, 1903. The other officers were as follows:

Secretary—F. E. Lloyd.
Councillor—Wm. Trelease.
Sectional Committee—T. H. Macbride, vice-president, 1904; F. E. Lloyd, secretary, 1904–1908; F. V. Coville, vice-president, 1903; C. J. Chamberlain, secretary, 1903; W. A. Kellerman (one year), F. S. Earle (two years), C. E. Bessey (three years), W. T. Beal (four years), F. E. Clements (five years).
Member to General Committee—C. L. Shear.

Meetings of the section for the reading of papers and for other business were held on December 28, 29, 30, 31 and January 1. The Mycological Society and the Botanists of the Central States met conjointly with the section.

A committee consisting of Professor C. E. Bessey, Dr. B. T. Galloway and Professor C. MacMillan drew up a resolution strongly endorsing the efforts at present being made looking toward the passage of such laws by Congress as will provide for the perpetual preservation of the Calaveras Grove of Big Trees in California.

On Friday morning the section, together

with visiting botanists, had the pleasure of paying a visit to the Missouri Botanical Garden, where, under the guidance of Dr. Wm. Trelease and his staff, the various appointments and collections were examined with great profit and enjoyment. The section returned a vote of thanks to Dr. Trelease for his courtesy to the visiting botanists.

The following papers were presented:

The Work of the Year 1903 in Ecology: H. C. COWLES. (By special invitation of the sectional committee.) This paper will be published in full in SCIENCE.

Notes on the Botany of the Caucasus Mountains: C. E. BESSEY.

General characteristics of the mountains and their climate. The steppes north of the range. The vegetation of Kislovodsk, Bermamut, Kasabek and Ardon, on the north side. Vegetation of the Ardon Valley, the higher mountain slopes and the Rion Valley to Kutais. The forests of Colchis. Tiflis and its botanical garden. The region of Upper Armenia. The plains of Erivan on the Zenga River. The gardens at Batum and Chackva. Tea plantations and bamboo thickets at Chackva. The forests of the northeast shores of the Black Sea.

The Cypress Swamps of the Saint Francis River: S. M. COULTER.

The Saint Francis River covers wide stretches of lowland in Missouri and Arkansas with a varying depth of water. At some seasons these lands are dry, at others covered with two feet of water. Submerged aquatic plants cover the river bottom and *Polygonum densiflorum* seems to be the first aerial plant; *Zizaniopsis miliacea* succeeds it very closely; *Peltandra undulata, Saururus cernuus* and *Typha latifolia* are next in order, then a willowy undergrowth, succeeded by *Cephalanthus occidentalis; Nyssa uniflora* and *Taxodium distichum* occupy the next zone and are the principal forms which have worked out so-called adaptations to their habitat.

The young trees of *Nyssa uniflora,* the tupelo gum, are crowded in pure groves, and as they increase in size they develop a peculiar bulging in the trunk near the water line. These dome-shaped bases become as much as twelve feet in diameter and are accompanied by the decay of the central tissue in base and trunk. Upper portions of the trees are usually blown away, leaving a hollow shaft thirty or forty feet high. The habitat of the cypress is similar. The young groves are not so unmixed as those of the tupelo. The cypress base, instead of being dome-shaped, becomes conical, but does not decay in the center. The development of the cypress 'knees' or upward enlargements of the roots is another peculiarity of the cypress growing in water. They are enormously developed in the Saint Francis region, sometimes reaching a height of eight feet above the ground. When cypress grows under mesophytic surroundings, neither the enlargement of the base occurs nor the development of knees. Beyond the cypress-tupelo gum association is found a large variety of shrubs and trees. The tension line between the cypress and most broad-leaved trees seems dependent upon the amount of water; the cypress can live on land or water, but the other forms only on land. However, they are more vigorous under those favorable conditions and soon occupy the land to the exclusion of the cypress. These marginal forms include *Liquidambar styraciflua,* white and red oaks, sassafras, sycamore, *Celtis Mississippiensis, Nyssa sylvatica* and a large number of shrubs.

Ecological Notes on the Islands of Bermuda: S. M. COULTER.

The Bermuda Islands are composed of porous limestone with a thin covering of soil. The nature of this substratum prevents the accumulation of water excepting a few brackish ponds near the level of tide-water. Conditions of moisture and exposure are very uniform, hence plant associations are not large, nor do they vary widely. The largest ecological area comprises in a general way all the hillsides and slopes that have sufficient soil to support a large vegetation. Their appearance is somber on account of the large number of cedars which cover them. Two species of *Lantana* (called the Bermuda sage-brush) are associated with the cedars, and crab-grass and cape-weed cover the ground. Tall oleanders are marginal to the cedar groves and *Yucca alsifolia* is abundant along the cliffs. A second area comprises the rocky shores along the ocean, characterized by gnarled forms of *Conocarpus erectus, Borrichia arborescens, Solidago sempervirens* and *Opuntia Tuna*. A third area is formed by the sandy beaches and small dunes along the south shore. The sea blackberry, *Scævola lobelia,* is the most abundant form and *Ipomœa pes-capræ* is almost as common, trailing its long vines over the sands and helping to bind them together. Secondary in importance are *Cakile æqualis, Tournefortia gnaphaloides,* the golden-rod mentioned above and the sea ox-eye, *Borrichia arborescens.* These mesophytic and xerophytic areas are most prominent, but there are two types of swamps to be noted. The Devonshire marsh was apparently once a large pond but there is little water left. Two species of *Sphagnum, Proserpinaca palustris, Typha latifolia* and *Eichornia* occupy the lower pools. *Hydrocotyle Asiatica* and *Herpestis monniera* are rooted in the mud. *Osmunda Cinnamomea* and *O. regalis* are abundant in somewhat drier places, while in the dry, peaty soil *Pteris aquilina cordata,* the cedar, palmetto and dog-bush are most common. The mangrove swamps about small inlets of the sea constitute the second hydrophytic area. The aerial roots from the limbs of *Rhizophora Mangle* and the curving prop-roots add considerable interest to these swamps. The seeds begin to grow on the trees, then drop into the mud, their pointed ends fixing them upright, while the growing roots soon penetrate the soil and a pair of leaves appear at the upper end. *Avicennia nitida,* the false mangrove, is associated with the true and along the tide-water margins are *Salicornia fruticosa, Statice Lefroyi, Sesuvium Portulacastrum* and *Coccoloba uvifera.*

A Lichen Society of a Sandstone Riprap: BRUCE FINK.

A general discussion of the conditions under which the society has developed and is now growing, including some statement as to amount of moisture in various portions of the riprap, amount of disintegration at various points and amount of exposure to sun and wind. Following this is a consideration of the ecologic conditions and resulting spermaphytic flora in the area, and the effect of these surroundings on the composition of the lichen society. Next in order is given a list of the lichen species of the society, followed by a discussion of the conditions under which each species is growing and the adaptations of each species to these conditions. Brief comparisons are made between this society and three others found on sandstone, and herein are shown some very marked responses between ecologic conditions and structural adaptations.

Relation of Soil to the Distribution of Vegetation in the Pine Region of Michigan: E. B. LIVINGSTON.

The study here reported is of about fifteen townships lying in Roscommon and

Crawford Counties, Michigan. The soils are classed as clay, clay loam, sandy loam, and sand, power to hold and lift water from an underground water level decreasing with the different soils in the order named. The region is glacial and consists of ridges and plains. The former are usually gravelly and sandy loam. The latter are loamy sand, clay or nearly pure sand. Some ridges are quite clayey. The vegetation is divided into (I.) upland and (II.) lowland types. Of the former are considered the following, named for the characteristic tree species: (1) The hardwood, (2) the white pine, (3) the Norway pine and (4) the jack pine. These types become more xerophytic in character in the order named. In general, the upland types follow in their distribution the distribution of the soils, the hardwood occurring on low clay plains, on swamp margins in loamy soil, and on certain plains of loam which are well covered with humus. The white pine occurs on certain ridges of clay loam and of clay and also on swamp margins in loam and clay. The Norway pine type is found on loamy sand plains and on the ridges of sandy and gravelly loam. The jack pine type occupies exclusively the well-washed sand plains. The only complicating factors in distribution are the effect of humus (which seems able to make even sand able to support hardwood) and the effect of the rise of the underground water level, as at swamp margins. The latter makes a sandy soil able to bear vegetation which would otherwise be found only in loam or clay. Analyses of the soil seem to show that its chemical properties are unimportant, that the real factor to determine distribution is the power of the soil to hold water, this power increasing with fineness of particles or with presence of humus.

Research Methods in Phytogeography: F. E. Clements.

(1) The use of simple and automatic instruments, photometer, psychrometer, thermometer, etc., in the exact determination of the physical factors of a habitat; (2) the study of the structure and development of formations by means of permanent and denuded quadrats, and migration circles; (3) experimental ecology in the field by moving plants from one habitat to another, or by modifying the controlling factor of a habitat; (4) experimental ecology in the plant house by equalization and control of physical factors.

Ensayo para la formacion de un foto-herbario Botanico y medico de la flora Mexicana: Fernando Altamirano.*

Contendrá una collección de 6000 fotografías tomadas de los especimenes del Herbario de Plantas Mexicanas del Instituto Medico Nacional. Cada fotografía será de y llevará dos etiquetas: una corresponderá al Colector y tendrá los datos de clasificación, lugar de vegetación, etc., y la otra corresponderá al instituto, conteniendo los nombres vulgares, las rectificaciones que se hayan hecho á la clasificacion, etc. Cada lámina del Foto-herbario, que contendrá 4 foto-grafías, irá accompanada de una hoja de igual temaño (0.20 por 0.25 próximamente), conteniendo datos descriptivos, aplicaciones y la distribución geográfica con su mapa respectivo. Las plantas del Herbario serán fotografiadas en órden de familias naturales, comenzando por las Ranunculaceas. Cada lámina contendrá solamente especies de un mismo género, especies que irán numeradas progresivamente, tal como se representa en la muestra que se remite, la cual comprende 100 fotografías. La impresión del texto y el tiro de las láminas, lo hará

* La palabra foto-herbario sera substituida por otra si se considerare inadecuada.

el Instituto, en número de 1,000 ejemplares, que repartirá en toda la República y á las corporaciones científicas extrangeras. El objeto de la publicación de este Foto-herbario es facilitar el conocimiento de nuestras plantas á toda clase de personas, aún de aquellas que sean menos versadas en la Botánica. Para eso se presenta la figura de la planta que atraé la atención y facilita las descripciones; y por eso tambien se dán á conocer las aplicaciones y el lugar donde vegeta una planta, lo cual aumenta el interés por conocerla y facilita su adquisición á los colectores. Formará pues, este Foto-herbari o un catálogo como el que acostumbran publicar los botánicos de sus herbarios; pero con la ventaje de que el Foto-herbario es un catálogo y un herbario á la vez, podriamos decir, acompañado de otras muchas notisias que no se acostumbra poner en los simples catálogos. Este Foto-herbario puede tener una aplicación más amplia todavía, y ese es mi deseo, que comprenda las Fotografías de todas las plantas mexicanas conocidas. Para consequirlo me propongo que tambien sean fotografiados los especimenes de los herbarios extrangeros que no tengamos en los de México. Asi por ejemplo, procurarémos fotografias de aquellas plantas mexicanas, de los herbarios de los Estados Unidos, de los de Europa, etc. A la vez que trabajemos en México se procurará que tambien se trabaje, sobre el mismo asunto, en los herbarios de fuera, siguiendo un plan determinado para que cuando al fin de algún tiempo (dos años probablemente) que se haya completado le colección de las fotografías de la Flora Mexicana, no resulten desordanadas ni haya repeticiones. Si pues se considerare útil la publicación del Catálogo del Herbario del Instituto, según la manera que he indicado, y que sea aplicable á toda la Flora Mexicana, procuraremos fotografiar cuanto antes, todas las plantas de los herbarios que haya en México, y yo me atreveré á pedir desde ahora la valiosísima cooperación de los botanicos de todas las naciones. Ojalá que esta autorizada Asociación tuviera á bien iniciar el monbramiento de una Comisión que se siriera dictaminar sobre cual seria la mejor manera de llevar á cabo la formación de un Catálogo General de la Flora de cada Nación ó sea un Foto-herbario-Pan-Americano.

The Alamogordo Desert; A Preliminary Notice: Thomas H. MacBride.

The Alamogordo Desert is situated in southwestern New Mexico; it is a bolson, *i. e.*, an undrained desert plain. The topography of the region and its geology are briefly described and an effort made by illustration and description to connect the present distribution of the flora with geological history. It is claimed that in this desert, as often in other parts of the country, the distribution problems can be understood only as the geologic story is more or less perfectly read. The flora of the plain is contrasted with that of the mountain side and summit.

The Flora of the St. Peter Sandstone in Iowa, An Ecological Study: B. Shimek.

The distribution of the St. Peter exposures in Iowa. The physical characters of the St. Peter sandstone. A brief discussion of the plants which are peculiar to it. A corresponding discussion of the plants which are common to rocky ledges and which also occur on the St. Peter sandstone. A more detailed discussion of a series of plants which normally belong to other habitats, but which have gained a foothold on the sandstone, or on the sands resulting from the decomposition of the sandstone. These latter are very much developed.

An Ecologically Aberrant Begonia: William Trelease.

An account of a Mexican species of *Begonia* possessing a single large sessile leaf closely applied to the cliff on which the plant grows, so as to afford protection to its roots.

Plant Formations in the Vicinity of Columbia, Mo.: Francis Daniels.

The vegetation of the region falls into four main classes: (1) The aquatic and subaquatic floras; (2) the mesophytic, or in poor soil, xerophytic, sylvan flora; (3) the rupestrine flora of the limestone cliffs; (4) the cultural and ruderal floras. The aquatic and subaquatic vegetation falls into six zones: The aquatic, amphibious, limose, ulignose (wet swamp), paludose (open marsh) and riparian zones. The mesophytic (or xerophytic) sylvan flora assumes five main types: The alluvial, the mesophytic sylvan proper, the open brush, the arborescent glade and the sterile hill type. The rupestrine flora exhibits four types: The fontinal or dripping rock, the soil-covered ledge, the bare rock and the cliff summit types. The cultural and ruderal floras have the forms proper to pastures, meadows, fields, orchards, gardens and waste places. Besides these there are a host of parasitic and saprophytic fungi, and a few flowering plants, like *Cuscuta, Thalesia* and *Monotropa.*

The Distribution of Some Iowa Plants; Formations on which they Occur: L. H. Pammel.

A brief account of some of the more important plants found on the carboniferous sandstone in eastern Iowa, noting the occurrence of the white pine, *Pinus Strobus, Gaylussacia resinosa, Aspidium marginale, A. acrostichoides, Lycopodium lucidulum, Phegopteris Dryopteris, Diervilla trifida* and *Danthonia spicata.* The occurrence of boreal types like *Salix candida, Lobelia Halmii, Cnicus muticus, Gentiana crinita.*

The Chemical Constituents of a Soil as Affecting Plant Distribution: S. M. Tracy.

The author calls attention to the fact that the distribution of plants is often attributed wholly to the physical and mechanical condition of the soil, though in many cases the chemical constituents of the soil are equally potent.

Vegetation of the North Shore of Lake Michigan: C. MacMillan.

A brief sketch of the characteristic shore and forest vegetation of the North Shore. The strong resemblance of this to the mountain vegetation of British Columbia was pointed out. Not only does the resemblance appear in the many northern species, but more particularly in the general association of plants and the relative preponderance of generic types.

Zones of Vegetation About the Margin of a Lake: W. J. Beal.

About a mile and a half northwest of Lansing, Mich., is a natural pond which goes by the name of Jones' Lake with an outlet at the west. The lake is nearly circular in outline and about forty rods in diameter. There is a slight extension both to the north and to the south. The bottom and the shaky margins all around consist uniformly of dark mud, ooze or muck. The lake contains a few species of fish, such as sunfish, blue gills and spotted bass. From the soft banks within two to three rods, the bottom uniformly descends rapidly to deep water. I examined the margins of this lake on August 23, 1903. Beginning with the deep water this is the order of the bands of some of the leading kinds of plants: (1) Potamogetons, not yet in fruit, prominent among which was *Potamogeton amphifolius* Tuckerman, which formed an unbroken band about the margin of the lake. (2) In most places a narrow strip of some species of *Chara.* (3) *Castalia tuberosa* (Paine) Greene, and *Nymphæa advena* Soland, usually mixed, but sometimes only one or the other, formed a band ten to thirty feet in width, and this band was rarely broken, and then only for a space of ten to thirty feet. (4) In many places were narrow patches of *Pontederia cordata* L., but scarcely ever in long strips. (5) *Typha latifolia* L., with very rarely an exception of a few feet, formed a band from five to twenty feet in width. (6) Sedges in variety with some species of rushes and grasses, and others of like needs formed an uninterrupted band. (7) Several species of *Salix,* or some one or two, surrounded the lake completely. (8) A band of *Larix laricina* (Du Roy) Koch was unbroken excepting for a few rods on the north, where it may have been formerly cut away next to a cleared farm. As the condition of the margins of the lake and surrounding it are so nearly uniform, we have reason to expect the zones of vegetation will be little if at all interrupted. As the descent of the bottom from the flat margins of the lake to the deep water are so rapid, there is only room for narrow zones of vegetation. Beyond the eighth zone (of *Larix*) in two places for a quarter of the circumference the slope rises rapidly to dry arable land, while in the remaining three fourths there are many kinds of aquatic and lowland plants. In all his travels, the author never remembers to have seen a place where so many zones of plants were so well marked for so long a distance as were found at Jones' Lake.

The Genus Harpochytrium, its Development, Synonymy and Distribution: G. F. ATKINSON.

Describes the genus *Harpochytrium,* its structure, formation of sporangia and spores; the movement of the spores and attachment to host. Also discusses the synonymy as well as the distribution of the genus in different parts of the world.

The Phylogeny of the Lichens: F. E. CLEMENTS.

(1) A general consideration of the underlying principles of polyphylesis; (2) a detailed discussion of the points of contact of fungi and lichens; (3) the treatment and classification of lichens as parasitic fungi.

The Necessity for Reform in the Nomenclature of the Fungi: F. S. EARLE.

Cites the conflicting usages in Engler and Prantl's 'Pflanzenfamilien' and in Saccardo's 'Sylloge Fungorum' to show that there is no unanimity in the use of genus names for fungi at the present time. Shows from unpublished data in regard to the types of the earlier genera that in forty-five per cent. of these cases the earliest available name is not used by Saccardo. Shows that this process of shifting generic names from one group of species to another is still in progress and urges that immediate steps be taken to put a final stop to the practice.

Taxonomic Value of the Spermogonium: J. C. ARTHUR.

The physiological significance of the spermogonium is yet unknown. It had been tentatively assumed to be associated with sexual reproduction as the male structure. It has been known for more than fifty years, and it still bears the name given by the discoverer, Tulasne, but its sexual character is still problematical.

The numerous forms of spores among the Uredineæ are shown to belong to two classes, the teleutospores, which are doubtless of a sexual character, and conidia, the latter being either æcidia or uredo. These follow in an invariable order. The spermogonium always appears in the life cycle as the first fruiting structure. If the first subsequent spore structure is the uredo, there is no æcidium in the cycle; if it is in the teleutospore, there is neither æcidium nor uredo. The presence and association of the spermogonia, therefore, furnish important information regarding the extent of the life cycle. The characters drawn from form, size and origin of the spermogonia furnish minor characters. The spermogonia, as well as any or all of the conidia, may be suppressed in certain species.

Proof of the Identity of Phoma and Phyllosticta on the Sugar Beet: George G. Hedgcock.

This paper gives the results of a cultural study of *Phoma betæ* and *Phyllosticta tabifica* in which two fungi are shown to be identical, both causing a similar rot of the root of the sugar beet, and producing upon inoculation upon the leaves the typical *Phyllosticta* leaf spots. The cultural characters of the two fungi are identical.

Craterellus taxophilus, A New Species of Thelephoraceæ: C. Thom.

A delicate fleshy *Craterellus* found at Ithaca, N. Y., is described and figured as new. Photographs, specimens and drawings of structure are presented, and show it to differ from previously described species. Its association with *Taxus,* which seems very close, is made the basis of the specific name. The technical description of the species as *Craterellus taxophilus* is added.

The Fungi Cultivated by Texas Ants: A. M. Ferguson.

The fungi found in the so-called 'mushroom gardens' of certain fungus-eating ants occurring in central and southern Texas (*Atta fervens* Say, *A. septentrionalis* McCook, *A. turrifex* Wheeler and *Atta* n. sp. Wheeler) consist of a white slow-growing mycelium with characteristic clusters of terminal swellings, the 'Kohlrabihäufchen' of Möller, which are eaten by the ants. While no kind of spore formation was found, it is probably the same as the form described by Möller from the gardens of Brazilian *Attas.* The fungus grows slowly in culture, but was often more vigorous than in the garden under the control of the ants. The formation of the characteristic swellings seemed to be governed by local conditions (probably controlled in the garden by the ants), for in cultures, on beans, for example, they would be formed in abundance in some tubes and not at all in others. Efforts to feed one species with the fungus grown in the garden of another, or from cultures, gave erratic results, rarely succeeding, and then only after prolonged starving. Some observations of Möller bearing on the systematic position of the fungus were unconfirmed. A *Dematium*-like fungus proved to be the organism cultivated in the nests of *Cyphomyrmex rimosus.* This ant was supposedly carnivorous until its fungus-feeding habit was observed by Dr. W. M. Wheeler. In this case caterpillar pellets are used exclusively by the ants for a medium upon which to grow the fungus.

Symbiosis in Lolium: E. M. Freeman.

In a previous paper I have described the unique year-cycle of the fungus symbiont of *Lolium temulentum* and other species of *Lolium.* Further experiments support the theory that the fungus does not form spores. There are two races each, of *L.*

temulentum, L. perenne and *L. linicola,* one with and one without the fungus symbiont. Of these the with-fungus race is the slightly more vigorous. Present knowledge points to the probability that the fungus is an *Ustilagene,* which has lost its power of spore formation and has adopted a method of intraseminal mycelial infection at the first appearance of the stem growing point. Infection of without-fungus plants seems impossible, as is also the elimination of the fungus from the with-fungus plants.

Mitotic Division of the Nuclei in the Cyanophyceæ: EDGAR W. OLIVE.

The 'central body' in the Cyanophyceæ is a nucleus, not essentially different from the nuclei of higher plants. When conditions for growth are favorable, the vegetative cells divide with unparalleled rapidity, so that their nuclei are rarely in a state of rest. Consequently during this period of mitotic division a nuclear membrane is not present. In spores and heterocysts, on the other hand, the nuclei form nuclear membranes and they resemble, furthermore, in other respects the resting nuclei of the higher plants. When in division, the 'central body' is made up, for the most part, of a more or less dense kinoplasmic achromatic substance, which corresponds to the spindle, and which is composed both of mantle fibers, attached to the partition walls of the cell, and of connecting fibers. The chromosomes, which can be successfully demonstrated only by careful differentiation of stained material, are very minute, and are usually sixteen in number. In the large species *Oscillatoria princeps* and *O. Froehlichii,* however, there are thirty-two, while in *Nostoc commune* and in *Gleocapsa polydermatica* there are but eight chromosomes. In *Gleocapsa* the plane of division of the chromosomes is exceptional, in that it takes place at right angles to the resulting plane of division of the cell. In all the other forms studied, embracing five genera, the plane of division of the chromosomes is normal, being parallel to the resulting plane of division of the cell. In the filamentous forms division of the cells takes place with wave-like regularity; and in all cases studied, with the exception of *Gleocapsa,* division of the cell is accomplished by the growing in from the peripheral wall of a ring-formed wall. In *Oscillatoria* several ring-shaped walls, in different stages of growth, may be present at the same time in the same cell, long before the one first formed has completely divided the cell. Two kinds of granular inclusions, which are characteristic of the Cyanophyceæ, the cyanophycin granules and the slime globules, or 'central granules,' are usually present in the cytoplasm. The peripheral position of the cytoplasm is generally differentiated into a denser, fibrous region—the chromatophore—which contains the diffused green and blue coloring matters. No evidence whatever was found of the presence of minute globular chloroplasts, such as several investigators say are present in certain forms. In this investigation the conclusion was reached that the cell organization of these low plants can not be successfully studied except in thin sections, cut longitudinally as well as crosswise.

Chemical Stimulation of Algæ: E. B. LIVINGSTON.

The study was carried on with the polymorphic form of *Stigeoclonium* previously worked with by the same author. In the previous work it was shown that with relatively high osmotic pressure of the medium the alga produces only spherical cells, a *Palmella* or *Pleurococcus* form. With low osmotic pressure it grows out with long branching filaments. Zoospores are formed only with low osmotic pressure and they germinate to form filaments. If filaments are placed in a medium of high pressure they break up into round cells or form groups of round cells. When the solution of low osmotic pressure has added to it a trace of such a poison as nitric or sulfuric acid, copper sulphate, silver nitrate, etc., the alga takes the *Palmella* form as though the pressure were high. If the poison is still more dilute there is a stimulation of zoospore production, though the zoospores are checked in germination. Nitrates and sulphates were used and it appears that the poison kations have the effect of producing the *Palmella* form in a solution whose osmotic pressure is far too low to bring about this result. The kations so far studied are: H, Li, Rb, NH_4, Cu, Ag, Al and Fe. All of these also produce stimulation of zoospore production when in weaker solution, and to the list may be added Ba and Sr.

The Differentiation of the Strobilus: F. E. Clements.

(1) A brief consideration of the antithetic evolution of the sporophyte from *Tetraspora* to *Anthoceros;* (2) a discussion of the probable origin of *Selaginella* and *Isoetes;* (3) the derivation of the strobilus of *Pinus, Myosurus* and *Alisma* from *Selaginella;* (4) the general ecological principles involved in the modification of the strobilus; (5) the essentials of the phylogenetic method.

The Histology of Insect Galls: M. T. Cook.

The function of the gall is to furnish nutrition and protection for the larva. The simplest galls only show two zones, the inner nutritive and the outer protective. The most highly developed galls show four zones, the second and third often separated; the innermost zone is nutritive and the other protective. When the gall first forms it is a mass of irregular parenchyma cells which soon become differentiated into the zones. In the simplest galls, where we have only two zones, the inner nutritive zone is rich in protoplasm, starch, etc., until the insect is near maturity, while the other zone forms tannin. In the most highly developed galls, tannin is also developed in abundance. The innermost zone is very rich in nutrition, the remaining three zones are protective. The separation of the second and third zone is undoubtedly a protective device. The shape of the gall and its complexity are probably due to efforts for protection against parasites and birds.

Morphology of Caryophyllaceæ: M. T. Cook.

Some time since the writer published a short paper on *Agrostemma Githago* L. and *Claytonia Virginica* L. Among the most interesting points in these papers was the formation of the peculiar beak to the ovule and the two zones of the nucellus in *A. Githago.* The writer has since continued the study upon two species of the Caryophyllaceæ for the purpose of demonstrating the importance, if any, of the morphology of the embryo sac and surrounding structure in taxonomy. The two species selected for study were *Vaccaria Vaccaria* (L.) Britton and *Alsine pubera* (Michx.) Britton. In both cases a beak is formed similar to *A. Githago* and the embryo follows a similar line of development, but the sac enlarges in the same manner and direction as in *C. Virginica.* Other points are as yet not definitely determined.

The Phylogeny and Development of the Archegonium of Mnium cuspidatum: G. M. Holferty.

After brief statements in regard to the collection and method of treatment of material, and the terminology to be used, the author reviews the more important literature on the development of the moss archegonium from 1851 to the present. A summary of this literature shows considerable divergence in the opinions and interpretations of the several investigators. The crux of discussion has been in respect to the origin of the members of the axial row, but particularly whether the terminal cell (cover cell of liverworts) adds to the row after its first division. The discovery of a mitotic figure in this cell after one cell had been cut off enables the writer to decide this question affirmatively. In a second part of the paper, the author demonstrates the homology of archegonia and antheridia from the standpoint of (*a*) homology of the organs as indicated in early stages of development; (*b*) homology of the egg and other members of the axial row; (*c*) the homology of the members of the axial row and sperm mother cells. From certain bisexual organs, and from abnormal or slightly modified forms of both archegonia and antheridia, the author is able to offer support to recent views as to the phylogeny of the archegonium and to throw light upon the meaning of abnormal forms, and particularly to groups of cells at the apexes of certain archegonia for which up to the present no adequate interpretation has been suggested.

The Enzyme-secreting Cells in the Seedlings of Zea Mais and Phœnix dactylifera: HOWARD S. REED.

During the process of germination, the above-named seedlings produce an enzyme for the solution of endosperm. The enzyme is secreted from a differentiated layer of cells. These cells show continuous morphological changes during the time the enzyme is being secreted. When secretion begins the cells of the secreting layer are full of the fine proteid granules, which are thought to be zymogen, because, as secretion progresses, they constantly disappear. In the early stages of secretion the nuclei of the secreting cells of *Zea Mais* are found in the basal end of the cell; in the later stages they are in the apical end next the endosperm layers. As secretion progresses, there is a continuous increase in the amount of chromatin in the nuclei of the secreting cells. At the same time the nucleoli decrease in size and staining properties. At the end of the process the protoplasm of the secreting cells breaks down and the products of disintegration disappear from sight.

Discoid Pith in Woody Plants: F. W. FOXWORTHY.

Discoid Pith: Any pith which is interrupted at frequent and tolerably regular intervals by transverse partitions dividing the pith up into a series of chambers. These partitions, disks, diaphragms, plates or lamellæ, as they are variously called, may be composed either of thick-walled or of thin-walled cells, and the spaces between the disks may be empty or filled with cellular tissue. Thus, M. Gris classifies discoid pith as: (1) Heterogeneous continuous diaphragmatic, when the pith is continuous between the disks, and (2) heterogeneous discontinuous diaphragmatic, when the pith is not continuous between the disks, but the interspaces filled with air. The first type of pith is found in *Liriodendron, Magnolia* species, *Asimina, Nyssa,* etc., and the cells forming the disks are very thick-walled and heavily lignified, while the cells forming the interspaces are small, very thin-walled and empty. The second type is found in *Juglans, Pterocarya, Celtis, Halesia, Forsythia viridissima, Jasminum* species, *Paulownia*, etc., and the cells forming the disks are thin-walled, empty and often shrunken. Discoid pith seems to be of taxonomic importance for generic distinctions in some cases; though the characters it furnishes may be of only specific rank, as in *Forsythia* and *Jasminum.*

A Plea for the Preservation of Our Wild Flowers: C. E. BESSEY and S. COULTER.

Cultivated flowers are planted and cared for by man, but no one cares for the wild beauties of the woods and meadow. We must preserve them. It is our privilege as lovers of plants to care for them and to see that they are not exterminated. The rarer the plant the greater the danger that it will be eradicated. Who are the offenders? The tourists, who lay their vandal hands on everything pretty; the amateurs, who desire to have samples of everything; and some botanists who think more of collecting specimens than of the beauties of nature in the field. At Colorado Springs the once beautiful Cheyenne Canyon has been made barren by the vandals, and there is scarcely a fern or a pretty flower now left in it. What shall we do about it? First of all let us talk vigorously against this vandalism. Talk in season and out of season, and denounce the wholesale destruction of wild flowers in the strongest language possible. Then write against vandalism. Do not fail to say what you think through the public press. The newspapers will help you every time if you call upon them. Then organize clubs and guilds and societies. Do this as you please. If you prefer to form a local chapter of the Wild Flower Preservation Society well and good. We shall take great pleasure in helping you. But if you prefer to form an independent club—do so by all means. It is not how you do it; it is only that you do something. Agitate the matter persistently and vigorously, and keep at it. In this way, only, may we hope to save our attractive wild flowers from extinction.

Type of the Genus Agrostis: A. S. HITCHCOCK.

In view of the fact that stable generic nomenclature depends upon the method of fixing the type of each genus, investigations concerning the effect of various rules upon different genera must be carefully worked out. For this reason the history of the grass genus *Agrostis* is presented. The effect of the application of different rules will be shown.

The Morphology of Elodea Canadensis: R. B. WYLIE.

The pistillate flower is strongly epigynous, the fused parts of the flower forming a long floral tube which extends from the sessile ovary to the surface of the water. The stamens each bear two sporangia and the staminate flowers at maturity break loose from the stem and rise to the surface of the water. The rise of these flowers is aided by bubbles of oxygen. Though the pollen grains are heavier than water, the multitudes of spines on the exine hold back the surface film, thus imprisoning enough air to keep the spores afloat. The male cells, which are formed in the pollen grains, are very large, and during their continuance in the spores remain joined together. The pistillate flower opens upon reaching the surface of the water and the stigmas soon recurve, arching out over the floral parts. Since the stigmas are impervious to water, the weight of the flower resting on them forms a depression in the surface film. Pollen grains floating near are now attracted to the flower by gravity, operating through the declined surface film. They approach and drop into this depression in contact with the stigmas. In the development of the embryo-sac, four megaspores are usually formed, though six were noted in one instance. The embryo-sac at the two-celled stage develops an antipodal pouch, in which the antipodal group of nuclei is formed. The pollen tube shows a marked development. Its course is down the floral tube, thence directly through the ovarian cavity to the upturned micropyles of the ovules. The pollen tubes that have failed to enter ovules often swell up at their tips into tuber-like enlargements, which may be fifteen times the normal diameter of the tube. In these tubers which lie among the ovules, the male elements can be made out, each distinctly a cell, rather than a nucleus only. About each male nucleus, which usually shows a nucleolus, is an ample cytoplasm bounded by a membrane. The functioning pollen tubes pass through the micropyle and seem to enter one of the synergids. Numerous preparations showed one sperm in contact with the egg nucleus, and in several instances the second sperm was found fusing with the endosperm nucleus. The egg regularly divides before the primary endosperm nucleus. The functioning pollen tubes persist for a long time, sometimes until the embryo is well developed.

Prothallia of Botrychium obliquum: H. L. LYON.

During the summer of 1903 gametophytes of *Botrychium obliquum* were collected in considerable numbers in Minnesota. In shape they resemble those of *B. Virginianum* but average only about one third the size of the latter. The reproductive organs are borne dorsally and do not differ essentially from those of other Ophioglossaceæ described. The embryo sporophyte is bipolar instead of tripolar as in *B. Virginianum,* the stem growing directly upward and the root directly downward through the prothallium. There is no pronounced nursing-organ. All the superficial cells of that portion of the embryo lying within the tissue of the gametophyte apparently act as absorbent cells. The primary root usually protrudes 1 to 3 cm. from the prothallium before the first leaf bursts through the calyptra.

The Life History of Ephedra trifurca: W. J. G. LAND.

Material for a morphological study of *Ephedra trifurca* was obtained in the vicinity of Mesilla, N. M. Collections were made at regular intervals between December 20, 1902, and May 20, 1903. The primordium which gives rise to the staminate flowers was apparent in the first material collected. The perianth appeared a month later. The primary wall cell divides to form two layers, the wall cell and the tapetum. The microspore mother cells remain in the resting condition about one month. The reduction division occurs about March 15. The gametophyte number of chromosomes is twelve. The male gametophyte at the time of the shedding of the pollen grain consists of two prothallial cells, tube nucleus, stalk cell and body cell. The body cell divides shortly before fertilization occurs. The ovule has two integuments: an outer one resulting from the fusion of four bracts, the inner one from the fusion of two bracts. The megaspore mother cell appears about March 8. Sometimes two or three megaspore mother cells are present, but only one megaspore functions. As the result of the division of the megaspore mother cell a row of four or sometimes three megaspores is formed, the lowest one being of course functional. The division of the megaspore is followed by free nuclear division and parietal placing. At least 256 nuclei are formed before walls appear. One, two or three archegonia are formed, and the central cell is placed deeply in the tissues of the gametophyte. The ventral nucleus is cut off shortly before fertilization, which occurred the present year about April 20. The oospore forms from two to eight free nuclei, each one of which organizes a wall and gives rise to an embryo. The normal number of free nuclei is in general four. The single suspensors are very long and thrust the embryos deeply into the endosperm. Only one of the embryos develops.

The Effect of Chemical Irritation upon the Respiration of Fungi: ADA WATTERSON.

These experiments concerning the effect of chemical irritation upon the respiration of fungi were carried on with the Kunstmann and with the Pettenkofer forms of apparatus. The fungi used were *Sterigmatocystis nigra* and *Penicillium glaucum,* and the irritants were $ZnSO_4$, $FeSO_4$ and LiCl. The results go to show that although the economic coefficient of the sugar is increased, yet the CO_2 respired by the fungus remains proportionally the same.

The Dehiscence of Anthers by Apical Pores: J. A. HARRIS.

The author presents a systematically arranged descriptive list of all genera in which the dehiscence of the anthers is by apical pores, and makes a series of comparisons of the floral structure of these forms with other members of the same family, showing the modifications in not only the stamens, but the other floral parts as well, upon the assumption of the apically dehiscent habit. The forms are divided into groups or 'types' on structural grounds and the ecological relations of these considered. While the types as a whole are not sharply limited, a pronounced similarity of form in the corresponding parts of the different genera is observable even when these belong to systematic groups differing widely in floral habit. For some of these types the geographical distribution of the genera and species has a similarity which does not seem to depend on systematic relationships. The only explanation which seems possible is that of the somewhat similar distribution of the Apidæ, upon which their structure indicates they are largely dependent for pollination.

FRANCIS E. LLOYD,
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GEOGRAPHY IN THE UNITED STATES. II.

IT has been maintained that one of the embarrassments from which geography suffers is the incoherence of the many things that are involved in its broad relationships. This is not really a serious embarrassment, and so far as it is an embarrassment at all it is not peculiar to geography. It is not a serious embarrassment, because when any element of geography is treated in view of the relations into which it enters, it becomes reasonably interesting to all who are concerned with scientific geography. The embarrassment is not peculiar to geography, for it is found in all other studies; in history, for example, where an essay by a specialist on the modern history of South America is not likely to excite an enthusiastic interest in the mind of the student of classic times in Greece, or in the mind of the student of medieval church history in Germany; the embarrassment is known also in geology, where the student of the petrography of the southern Appalachians, or of the paleontology of the Trias in California, may care little for a paper by a colleague on the glaciation of the Tian Shan Mountains in Turkestan. Yet, however unlike these various topics in history or in geology may be, they are welcomed, if well treated, by all the members of the expert society or by all the readers of the special journal in which they are presented, because they so manifestly make for progress in the science to which they belong. Geographers need not, therefore, be embarrassed on finding discussions of magnetic declination as affecting the navigation of the antarctic re-