agency. And even in cases in which the serum does possess antitoxic, or, as it would seem in some cases, germicidal properties, the bodies of the dead microbes must at last be got rid of by phagocytosis, and some recent observations would seem to indicate that the useful elements of the serum may be, in part at least, derived from the digestive juices of the phagocytes. If ever there was a romantic chapter in pathology, it has surely been that of the story of phagocytosis.

I was myself peculiarly interested by these observations of Metchnikoff's, because they seemed to me to afford clear explanation of the healing of wounds by first intention under circumstances before incomprehensible. This primary union was sometimes seen to take place in wounds treated with water-dressing, that is to say, a piece of wet lint covered with a layer of oiled silk to keep it moist. This, though cleanly when applied, was invariably putrid within twenty-four hours. The layer of blood between the cut surfaces was thus exposed at the outlet of the wound to a most potent septic focus. How was it prevented from putrefying, as it would have done under such influence if, instead of being between divided living tissues, it had been between plates of glass or other indifferent material? Pasteur's observations pushed the question a step further. It now was, How were the bacteria of putrefaction kept from propagating in the decomposable film? Metchnikoff's phagocytosis supplied the answer. The blood between the lips of the wound became rapidly peopled with phagocytes, which kept guard against the putrefactive microbes and seized them as they endeavored to enter.

If phagocytosis was ever able to cope with septic microbes in so concentrated and intense a form, it could hardly fail to deal effectually with them in the very mitigated condition in which they are present in the air. We are thus strongly confirmed in our conclusion that the atmospheric dust may safely be disregarded in our operations, and Metchnikoff' researches, while they have illumined the whole pathology of infective diseases, have beautifully completed the theory of antiseptic treatment in surgery.

I might have taken equally striking illustrations of my theme from other departments in which microbes play no part. In fact any attempt to speak of all that the art of healing has borrowed from science and contributed to it during the past half-century would involve a very extensive dissertation on pathology and therapeutics. I have culled specimens from a wide field; and I only hope that in bringing them before you I have not overstepped the bounds of what is fitting before a mixed company. For many of you my remarks can have had little if any novelty; for others they may perhaps possess some interest as showing that Medicine is no unworthy ally of the British Association; that, while her practice is ever more and more based on science, the ceaseless efforts of her votaries to improve what have been fittingly designated *Quæ prosunt omnibus artes* are ever adding largely to the sum of abstract knowledge. JOSEPH LISTER.

THE BUFFALO MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION G — BOTANY.

THE Botanical Section, G, of the A. A. A. S., held very successful sessions during the the meeting at Buffalo. Monday, the 24th of August at 11:40 a. m., the Section was organized and at 4:30 p. m., listened to the address of Vice-President, N. L. Britton on 'Botanical Gardens.' Tuesday, Wednesday and Thursday were devoted to the reading of papers and discussions. The papers were as follows:

The forces determining the positions of leaves: By R. N. Day.

Specimens of Phaseolus, Taraxacum, Cucurbita, Nicotiana, Helianthus and Arisæma were grown under the following conditions:

In darkness and in light.

a. Upright position.

b. Horizontal.

c. Inverted.

d. Horizontal or planostat.

Without discussion of the experimental details, it may be said that the conclusion of Vines that photo-epinasty does not exist is confirmed, and it is also concluded that epinasty and hyponasty are inherent properties whose reactions may be suppressed but whose general nature is not influenced by external conditions. Secondly, the results obtained bear directly on the recent conclusions of Vines and the current and accepted generalizations.

Vines' statement that dorsiventral organs are never apogeotropic is by no means substantiated, nor is it by any manner of reasoning to be inferred from the developmental history of the leaf. It might well be applied, however, to stems or flower structures. It may be seen from the author's and other results that dorsiventral leaves may be diaheliotropic, diageotropic or apogeotropic, epinastic or hyponastic. The factor determining the position of the leaf in every instance is the heliotropic tendency, which so far overbalances the influence of the other two forces that their reactions are suppressed. The position of the leaf then is a physiological, not a mechanical resultant, and may not be expressed by the parallelogram of forces as designed by Krabbe in 1889.

The bacterial flora of cheddar cheese: By H. L. Russell and John Weinzirl.

The study made by the author determines quantitatively and qualitatively the bacterial flora of our American cheddar cheese at the various phases of the ripening process. The first change from that in the milk is a diminution in number for the first ten days. In this the different species all suffer loss. Soon there begins an enormous development of organisms that is confined to lactic acid group of bacteria. The digesting and gas-producing bacteria gradually decrease in numbers. Succeeding this stage of bacterial increase is a period of gradual decline, which continues throughout the life of the cheese, until it is almost sterile in the course of a year or two. The physical changes that mark the curing of the cheese begin to appear synchronously with the marked development of lactic acid bacteria. The authors hold that these facts cannot be reconciled with the theory that the digesting bacteria are the active agents in the curing.

The pollen and stigma of Arisæma: By W. W. Rowlee.

The author described the androecium and gynœcium of *Arisæma triphyllum* and *A. Dracontium*. He noted the peculiarities of the consolidation of the stamens, the open style with the stigmatic hairs not only on the surface of the stigma, but also on the inner surface of the tube and forming a stigma like tuft on the inner surface of the ovary. The pollen in one case was found to have already germinated within the anthers, and the tubes had folded back and forth upon themselves. Other cases examined did not show the same growth.

Studies in nuclear phenomena, and the development of the ascospores in certain Pyrenomycetes: By Mary A. Nichols.

The results of the author's study point to the conclusion that a sexual process may be present in some members of the *Sphæriaceæ*, and absent or very degenerate in others. In *Ceratostoma brevirostre* the origin of the ascospore is distinctly traceable to a fusion of

differentiated gametes, while in *Teichospora* only possible rudiments of antheridia are present. The successive stages from the formation of the oosphere to the maturation of the ascospore reveal a process of development somewhat different from any heretofore suggested, but analogous to the development in *Sphærotheca*, described by Harper, and also somewhat similar to that in the *Florideæ*. The paper contains also an account of the discovery of nuclei in this family, their structure and behavior during division.

On the stem anatomy of the Onagraceæ: By FRANCIS RAMALEY.

As a result of the examination of specimens of seven genera of the tribe *Onagrariæ*, including thirteen species, the author found no marked anatomical specific or generic characters which could be used as a basis for classification.

Structures of the embryo-sac: By J. M COULTER.

The paper shows that the current statements concerning (1) egg apparatus, (2) primary endosperm cell and (3) antipodal cells should be modified as follows:

(1) *Egg apparatus:* two or three usually naked cells, the oosphere and one or two synergids, together representing a single archegonium, of which the synergids may represent canal cells.

(2) *Primary endosperm cell:* A cell formed by the fusion of two vegetative cells (the polar cells), which is stimulated normally by the act of fertilization to continue the vegetative development of the gametophyte, just as the adjacent sporophyte structures are stimulated to develop seed and fruit.

Antipodal cells: A group of cells, variable in number, evanescent or resistant; representing the vegetative region of the gametophyte not dependent for its development upon fertilization.

On Cratægus coccinea and its Segregates: By N. L. BRITTON.

The paper discussed the characters and distribution of *C. coccinea* and two probable varieties, *C. macracantha*, *C. rotundifolia* and *C. mollis* and was illustrated by specimens of all the forms described.

Notes on the genus Amelanchier: By N. L. BRITTON.

Specimens illustrating the five eastern species, *A. Canadensis*, *A. Botryapium*, *A. rotundifolia*, *A. spicata* and *A. oligocarpa*, were exhibited and their inter-relationships discussed.

Some Cyperaceæ new to North America, with remarks on other species: By N. L. BRITTON.

Record was made of seven species of sedges hitherto unknown to occur within United States, and specimens illustrating them were shown.

On the Cardamines of the C. hirsuta group: By N. L. BRITTON.

A discussion of the species *C. hirsuta*, *C. Pennsylvanica*, *C. flexuosa*, *C. parviflora* and *C. arenicola*, all of which were maintained as distinct. The paper was illustrated by specimens.

On the formation and distribution of abnormal resin ducts in Conifers: By ALEX. P. ANDERSON. The study shows that:

(1) Annual rings of *Pinus silvestris* and *Picea excelsa* containing frost rings have in cross sections fewer vertical resin ducts per sq. mm. than the normal rings.

(2) Regulatory tissue in hyponastic branches of *Pinus silvestris* has in cross sections fewer resin ducts per sq. mm. than the opposite side of the branch.

(3) In *Abies pectinata*, affected with *Æcidium elatinum*, the fungus mycelium is never found in the resin duct canals, nor in the epithelial cells surrounding the canals. Abnormal resin ducts are always found in

the wood of the thickened portion of the diseased branch.

(4) In *Pinus strobus* diseased at the root with *Agaricus melleus* an increase in the number of resin ducts of the wood takes place in the whole plant above the diseased part.

(5) In the wood of branches of *Abies pectinata* diseased with *Phoma abietina*, and in young seedlings of the same species, abnormal resin ducts are found only above the constricted portion of the branch.

An apparently undescribed Cassia from Mississippi: By C. L. Pollard.

This is a remarkable *Cassia*, allied to *C. chamæcrista*, but distinguishable by its virgate habit and strict pods, collected in northern Mississippi by S. M. Tracy. It proves, upon cultivation, to warrant its separation as a distinct species, for which the name *C. Tracyi* is proposed.

A discussion of the order Pesizineæ, Schröter: By E. J. Durand.

The author gave a brief history of the classification of the fleshy Discomycetes from the time of Linnæus, together with the ideas of modern systematists regarding the same plants. Especial attention was given to those of Schröter. The latter's views were discussed in the light of investigations, made by the author during the two years, touching the structure of these plants, illustrating the bases of their division into families.

A Bacterial Disease of the Squash-bug (Anasa tristis): By B. M. Duggar.

The author gave in brief the characters of a contagious disease first observed in a laboratory breeding cage. Many successful experiments were reported with both squash-bugs and young chinch-bugs. Isolation of the pathogenic *bacillus* and its growth on various nutrient media were described, likewise the microscopic characters and the distribution of the bacteria within the tissues of the host. Mention was also made of a toxic principle excreted by the organism, in an infusion of which many insects die almost immediately on immersion.

Grass flora of Iowa: By L. H. Pammel.

In the absence of the author the substance of the paper was given by J. M. Coulter.

Iowa lying between the two great rivers, respectively the Mississippi and Missouri, embraces an area of 56,025, it is well watered by its numerous streams and small lakes, all of which are intimately concerned in the distribution of plants. Among the streams are some of considerable size. About two-thirds of the State is drained by rivers that flow into the Mississippi and its tributaries. The largest wooded area is confined to the Mississippi and its tributaries. These wooded areas offer conditions that have greatly modified the distribution of grasses in this State. The country is not broken, but northeastern Iowa is extremely rugged. Along the Missouri occur the loess hills, with steep embankments and a loose friable soil. Concerning our grass flora the State is not greatly diversified. We have north, south, east, west, extra-continental and introduced species. In the number of species the State has less representatives than Nebraska on the west, than Illinois on the east and Missouri on the south. The southern indigenous types predominate, fellowed by northern. Only eleven of our species are typical western; thirteen are extra-continental, and fifty-five are introduced. Blue grass is the most abundant of our grasses. This is followed by *Phleum pratense*, introduced grass, and *Hordeum jubatum*, and *Elymus Canadensis*, followed by two typical Southern plants *Andropogon provincialis* and *Andropogon scoparius*.

A Contribution to our knowledge of the relation between growth and turgor: By Edwin B. Copeland.

An account was given of the state of turgor of seedlings of *Vicia faba* grown at various temperatures, and an explanation of the high turgor when growth is slow and *vice versa*. He concludes that the rapidity of growth regulates the amount of turgor present, rather than that the reverse is the case.

The relation between Thysanella and Polygonella as shown by a hitherto unobserved character: By JOHN K. SMALL.

The genus *Thysanella* has generally persistently and apparently without reason been referred to *Polygonum*. Besides ample characters in the habits and reproductive parts already recorded, the branching in *Polygonella* and *Thysanella* is internodal, and not nodal, as in all other members of *Polygonaceæ*.

An apparently undescribed species of Prunus from Connecticut: By JOHN K. SMALL.

A relative of *Prunus maritima* growing in the immediate neighborhood with it. The new species differs from the beach plum in habit, leaf form, flower and fruit.

The flora of the summits of King's Mountain and Crowder's Mountain, North Carolina: By JOHN K. SMALL.

Two isolated peaks with a moderate altitude harboring a local fern (*Asplenium Bradleyi*) and several members of the Alleghenian flora which we should not expect to find there. Their floras are shrubby, with the exception of two perennial herbs; one fern and a sedge, and about one-half the shrubs on King's Mountain are ericaceous. All the normally large forest trees occurring there are in the form of small shrubs ranging from three to six feet in height.

Rheotropism and the relation of response to stimulus: By F. C. NEWCOMBE.

Rheotropism is the change in direction of movement or of growth of an organism, induced by flowing water as a stimulus. Those organs or organisms that move or bend against the stream are *positively rheotropic*, while those moving in the same direction with the stream are *negatively rheotropic*.

It is now shown that the roots of many plants are positively rheotropic, while the roots of others are non-responsive. Moreover, the phenomena are marked by characters indicating irritability, since there is a latent period preceding the response and an after-effect following the stimulus.

We need not necessarily assume that the response shows a close biological relation to the stimulus used, since it is certain that in some cases the causal mechanism connecting stimulus and response may be set in motion by stimuli which are not the usual stimuli calling forth the response.

Some adaptations of shore plants to respiration: By HERMANN VON SCHRENK.

A large number of plants growing on the borders of ponds and rivers have developed structures adapting them to more or less aquatic conditions. These modifications are of two kinds, either the development of a mass of spongy tissue ærenchyma or the formation of very much enlarged lenticels, termed water lenticels. *Decodon verticillata* may serve as an example of the first. This plant always develops ærenchyma when growing in water. A few cases have been observed where the plant grew in drained ponds, and in those cases no ærenchyma was present. It seems to be well proved that this tissue is simply for respiratory purposes. *Sambucus canadensis* illustrates the second class. It has a large number of water lenticels developed at its base. These structures, however, are not always present. The same is true of a large number of plants which can grow as well in dry and moist localities.

On the roots of a number of plants, such as *Bidens connata* or *Eupatorium perfoliatum*, etc., structures occur similar to water lenticels which serve the purpose of aëration.

They are found on roots growing near the surface and in great numbers, especially in very damp soil. In development they differ from ordinary lenticels, owing to absence of initial stomata. Plants growing in similar localities, such as *Impatiens fulva*, *Myrica gale*, etc., never show such adaptation. The question arises as to the significance of these changes, which appear to be constant in the cases mentioned, and experiments on plants grown in water may serve toward solving the question.

A comparison of the flora of Erie Co., Ohio, with that of Erie Co., N. Y.: By E. L. Moseley.

Though both counties are adjacent, the Ohio district, so far as now known, contains 265 native species of phanerogams, not known to occur within 50 miles of Buffalo. The causes are said to be mainly climatic, the average date of the last killing frost in spring at Sandusky being April 30th, at Buffalo May 20th; and the first frost in autumn at Buffalo being September 15th, at Sandusky October 24th. One of the causes of the later spring at Buffalo is the blowing of the ice to the east end of the lake.

Sporophyll-transformation in dimorphic ferns: By Geo. F. Atkinson.

The author detailed the results of experiments conducted on *Onoclea sensibilis* and *O. struthiopteris*, showing that cutting off the vegetative leaves in the middle of May and again in June would cause the partial or complete transformation of the young sporophylls to vegetative leaves. The paper was illustrated by lantern views.

The significance of the compound ovary: By Charles E. Bessey.

In the study of the gynœcium of Angiosperms we are forced to conclude that its primitive condition was apocarpous — in other words, that whether monocarpic or polycarpic there was at least no union of ovary with ovary. The original ovary was doubtless simple.

By a comparative study of the ovaries of existing plants we are led to the conclusion that the syncarpous gynœcium was derived from the apocarpous gynœcium. This is so plain that it is needless to dwell upon it. Both phylogenesis and ontogenesis furnish us with numerous illustrations of the truth of this statement.

It is to be observed that the compound ovary is a comparatively stable structure, and that it changes slowly within any natural group, or in passing from group to group. No part of the plant is more stable. Yet with all its stability it undergoes changes in certain directions. It is a common occurrence to find a pentacarpellary ovary reduced to four, three, or two carpels, and this may proceed until, as in some of the Caryophyllaceæ, we seem to have but one carpel remaining. In rare cases there appears to be a reversion from syncarpy towards apocarpy, as in the Apocynaceæ and Asclepiadaceæ, but as a rule it may be said that syncarpy once attained by a group is persistently maintained, however much of simplification it may otherwise have undergone.

The ultimate development of the compound ovary is in the direction of a simplification of structure. Thus the many carpels of most Thalamifloræ and Heteromoræ are gradually reduced to the two carpels of the Bicarpellatæ. In the Calycifloræ the Rosales and Myrtales have generally several to many carpels, while in the Umbellales there are but two. Likewise in Inferæ the ovary in the lower group, Rubiales, have more carpels than we find in the highest group, Asterales. A similar simplification occurs in the Monocotyledons, as we pass from the Caronarieæ to the sedges and grasses.

This simplification of structure results in increased parental care of offspring. Thus

while many embryos are to be nourished in the earlier cases, there are but one or two in the later. The biological significance of this result is so well known as to need no discussion here.

When we come to an application of what we know of the compound ovary to systematic botany, it appears to me that the following conclusions are warranted:

(a) The apocarpous plants are to be regarded as lower than those which are syncarpous, and in a natural arrangement the former must precede the latter.

(b) We must carefully distinguish between ovaries which are primitively simple and those which have become simplified from a more complex structure. In these cases the first indicate a lower and the second a higher position in the natural system.

(c) Grasses, Sedges, etc., in which the ovaries are simplified from the compound type are not the lowest of the Monocotyledons.

(d) Willows, Oaks, Walnuts, etc., with their apparently simple flower structure, are not to be regarded as among the lowest of the Dicotyledons.

The influence of rainfall upon leaves: By D. T. MACDOUGAL.

The first recognition of the influence of rainfall upon leaf forms was that given by Ridley in his Flora of Rajang, and an exploitation of the subject was made by Stahl* in 1893. Since the publication of Stahl's work, Jungner has carried on a great amount of observational work of doubtful value and has made some attempts to produce rainfall characters in leaves experimentally. The rainfall characters of leaves recognized by these workers are as follows: Attenuated apices, entire margins, glossy appearance of the upper surface of the laminæ, coupled with a ready adhesion of water; deepened furrows above ribs, pendant positions of the laminæ and enlargement of the pulvini. It is to be noted, of course, that in no one species do all of the above characters appear, and furthermore that only a few of those named have been induced in leaves experimentally. Jungner was able to cause the glossy appearance of the upper surface of the laminæ and its adhesion to water, and a pendant position of the entire leaf in a few plants by experimental methods.

*Ann. d. Jard, bot. d. Bintenzorg, 1893.

The curvature of tendrils: By D. T. MACDOUGAL.

The curvature of tendrils in response to a contact stimulus is due to the contraction of certain cells on the concave side of the organ. These cells show great specialization in form, size and arrangement, and are markedly different from similar elements on the convex side. The protoplasm of the external cells exhibits some specializations and appears to correspond in density with the degree of sensitiveness. It has been found that the effects of a stimulus are not transmitted more than two centimeters from the point of its reception. The prevalent idea that the coiling of the free portion of a tendril is stimulated by the engagement of the tip with any solid object is found to be false, since the curvature of the organ in response to a stimulus and the coiling of the free portion are entirely independent processes; the latter ensues on maturity only, as may be seen if the tip of a young tendril is attached to a support.

Relation of the growth of leaves to the carbon dioxide of the air: By D. T. MACDOUGAL.

A large number of experiments were performed in which leaves of *Arisæma triphyllum*, *Calla palustris*, *Lilium splendidum*, *Trillium erectum* and *T. erythrocorpum*, *Isopyrum biternatum*, *Oxalis floribunda* and *O. vespertilionis*, *Justicea* sp. *Hibiscus rosa-sinensis*, *Zea mais* and *Phœnix dactylifera* were allowed to

develop under conditions of functional inactivity in light and in darkness. The amount of development or existence which can be carried on by the leaves of any of these species will depend on the 'availability' of the stored food. Ordinarily the leaf depends on its own activity for a portion of the material used for constructive purposes. Many of the leaves die when inactive in light, due to an insufficient food supply, and the disintegration of the chlorophyll is a result not a cause of the death.

The removal of concurrent members has a different effect on the remaining member when in light from that in darkness, a fact due in part to the intervention of the regulatory processes attendant on this condition.

In a series of experiments in my own laboratory, in which specimens of *Arisæma triphyllum*, *Trillium erectum* and *T. recurvatum* were subjected to a continuous spray of water for a period of 10 to 20 days, the author was able to produce the characters obtained by Jungner and also the additional one of diminution of the marginal teeth and deepening of the furrows above the ribs. In leaves of *Arisæma* the laminæ assumed an upwardly convexed form not to be confused with the rolling and twisting of leaves when subjected to abnormally cold water, and which is undoubtedly a new rainfall character.

It was found that the glossy appearance of the 'rain' leaves was due to the flattening of the outwardly convexed papillose ends of the epidermal cells of the upper side of the lamina, with a possibility of accompanying chemical changes in the character of the outer walls.

A comparative study of the development of some anthracnoses in artificial cultures: By Bertha Stoneman.

Seven different species of *Gloeosporium* and *Calletotrichum* and the allied genera *Vermicularia* and *Volutella* present in artificial cultures distinct characters varying to a certain extent with varying conditions of light, temperature and nutrient media. Under uniform conditions of growth the characters have been found sufficiently constant to be of value in distinguishing or uniting species whose similarity in morphological structure or variations resulting from the character of the host would render their systematic position uncertain. Of about thirty species studied, five (three *Colletotrichum* and 2 *Gloeosporium*), have been definitely connected with an ascigerous form; the transition from one stage to the other occurring without the intervention of a pycnidial stage. The ascigerous stages of each, two of which have been found as saprophytes in nature, bear a close resemblance to each other, and would fall in a genus near *Gnomomella*.

The habitats of the rarer ferns of Alabama: By L. M. Underwood.

A brief account of visits to Winston county, the type locality of *Trichomanes petersii*, was given, with some account of the habit of growth of that rare fern; also to Havana Glen, where *Asplenium ebenoides* grows in considerable abundance. This fern, which has been regarded as a hybrid, is shown by its habit to be a species entirely distinct from either of its supposed parents. The Southern fern-ally for a long time considered as a variety of *Botrychium ternatum*, is shown to be an entirely distinct species in form, habit and time of producing spores as originally shown by Lamarck.

Notes on the allies of the sessile Trillium: By L. M. Underwood.

Several species have been confused under this group name. Even Linnæus confused two species in the original description of *Trillium sessile*. One of these, an Alabama species figured by Catesby, was exhibited and attention was called to its value as an ornamental plant.

The Distribution of the Species of Gymnosporangium in the South: By L. M. UNDERWOOD and F. S. EARLE.

The distribution of the six species of *Gymnosporangium* parasitic on *Juniperus virginiana* was noted. An undescribed species was announced as most common in Alabama aside from *G. macropus* and *G. clavipes*.

Notes on the Pine-inhabiting Species of Peridermum: By L. M. UNDERWOOD and F. S. EARLE.

A revision of the species of the eastern United States, which number gives characters, distribution and hosts. The different character of the swellings produced by *Peridermum cerebrum* on *Pinus Tæda* and *Pinus echinata* were exhibited, the former with fusiform and the latter with globose swellings on twigs, branches or even trunks. The species produces much damage in some portions of the South.

The Terminology of Reproduction and of Reproductive Organs: By C. R. BARNES.

The speaker discussed first the distinction between vegetative and non-sexual reproduction. The reproduction of the earliest plants was undoubtedly vegetative reproduction. Non-sexual reproduction is not fairly differentiated from it until the *Bryophyta* are reached, and with them a clear alternation of generations. In *Bryophyta*, *Pteridophyta* and *Spermatophyta* the forms of vegetative reproduction, viz., by broodbuds, or gemmæ, by detached shoots and by proliferation (with detachment late when it occurs at all) are clearly distinguished from the non-sexual form, viz., by spores produced in a compound sporangium. The fundamental distinction lies in this, that vegetative reproduction *repeats the same phase*, while non-sexual reproduction *gives rise to the alternate phase*.

In the second topic discussed the classification of sporangia and gametangia into *simple* and *compound* was suggested. The simple gametangium or sporangium is one consisting of a single cell, whose contents become respectively the gametes or spores.

The compound gametangium or sporangium is an aggregate of several or many (rarely reduced to one) simple gametangia or sporangia surrounded by one or more layers of sterile protection cells. Oogonia and carpogonia are simple; archegonia are compound gametangia. Simple sporangia occur below the *Bryophyta*; compound in *Bryophyta* and above.

What is the Bark? By C. R. BARNES.

Attention was called to the varying use of this term by different botanists. The Germans use *Borke* and *Rinde* to denote respectively the external tissue of the root or stem which dries up, and the entire mass of tissue outside the cambium. In this they are followed by the English. The American usage, except as modified by foreign influence, assigns the name bark to the entire mass of tissue outside the cambium. In this use they are followed by the French, and the author advocated the use of bark in this sense, and cortex to designate certain parts of the bark, indicated by a preceding adjective.

The Development of the Vascular Elements in the Primary Root of the Indian Corn: By W. W. ROWLEE.

As a result of the author's investigation he finds that the large cells in the central portion of the root tip, which are usually stated to give rise to the vessels, pass over into parenchyma and that the first vessels are differentiated from cells nearer the surface.

Remarks on Chalazogamy: By J. M. COULTER.

In this paper the author considered: (1) Chalazogamy as a basis of classification. It was used at first by Treub in 1891. As the basis of grouping all angiosperms, chalazogams and parogams. It proves to be of no value even in the most minor classifica-

tions. (2) Chalazogamy as an indication of phylogeny. Nawaschin has maintained that chalazogamy is a transition stage between gymnosperms and angiosperms, in which the pollen tube seeks to adapt itself gradually to traversing cavities. Adaptation to cavities is shown by the author of this paper to be largely unnecessary, and chalazogamy gives no more suggestion of gymnosperms.

Ceres-pulver; Jensen's new fungicide for the treatment of smuts: By W. A. Kellerman.

The speaker gave an account of the above. The material consists of Potassium sulphide, to which are added in small quantity some other ingredients, regarded as important by Jensen. A solution of two pounds in 125 liters of water is poured on the grain, the latter being stirred thoroughly in the meantime. This fungicide is found by Jensen to be effectual in case of oat smut and barley smut. Prof. Kellerman has the past season tested the ceres-pulver, and corroborates Jensen's claim. He also stated that Jensen has recently published the fact that the experiments made in 1890 by himself and Mr. Swingle and reported in a bulletin of the Kansas Experiment Station, were the 'starting point' for the ceres-pulver. These experiments showed that potassium sulphide was an efficient fungicide for these smuts. The hot-water treatment has no superior, but farmers do not use it. Prof. Kellerman, therefore, recommends the use of ceres-pulver, and also of potassium sulphide.

Parthenogenesis in Thalictrum fendleri: By David F. Day.

In August, 1883, the author found in one of the cañons of Pike's Peak, Colorado, a seedling specimen of Thalictrum fendleri, and the plant was sent home for cultivation. The plant bore only pistillate flowers and matured seed. These seeds were the following year planted, and, in the judgment of the author, with no possibility of pollination, since there were no staminate plants, seed was matured. These results have been obtained for several successive years, and the phenomenon is regarded as an example of parthenogenesis.

What should constitute a type-specimen? By S. M. Tracy.

The speaker called attention to the want of uniformity in the term 'type,' 'duplicate of type,' 'co-type,' etc., and urges the necessity for the adoption of some uniform method of expression.

Remarks on the northern species of Vitis: By L. H. Bailey.

A discussion of the systematic position of certain native grapes. (In the absence of the author, read by title.)

The point of divergence of Monocotyledons and Diocotyledons: By Charles E. Bessey.

In discussing this question the speaker assumed that it is unnecessary to bring forward proofs as to the common origin of the two sub-classes, Monocotyledonæ and Dicotyledonæ. It is possible, but in his opinion improbable, that some plants are now included in them which have had an independent origin, but all will agree that after making the most liberal subtractions possible the two sub-classes must still remain as two very closely related groups, with essentially the characters now assigned to them.

We must bear in mind the well-known biological law that in general the relationship of allied groups is most marked between their lower members, that is, between those members which represent the primitive types, and that it is less marked between the higher members of the groups.

In other words, we recognize the fact that groups diverge as they are evolved. If we represent the phylogenesis of plants by lines we are compelled to arrange these lines so that they show repeated series of divergencies.

Another law which must be kept in mind, also, is that evolution for the most part has proceeded from the simple to the complex. The simpler plants of to-day represent to a large extent the types of the primitive plants of former periods, from which the complex plants of to-day were derived. In this connection, however, we must not overlook the fact, as pointed out elsewhere,* that in the evolution of the successive members of groups of plants there has often been a simplification of structure. Thus we often find apetalous derivatives from polypetalous types; bicarpellary ovaries from polycarpellary types; one-celled, one-seeded, compound ovaries from several-celled, many-seeded ovaries. But there is a great difference between these simplified structures, which have been derived from more complex structures, and those which are primitively simple. The former are nearer the end of a lengthened genetic line; the latter are nearer its beginning.

When we apply these principles to the system to Bentham and Hooker we find no contact points whatever between Monocotyledons and Dicotyledons. The lower Monocotyledons are very unlike any of the Apetalæ. What similarity, for example, is there between the Grasses and Sedges on the one hand, and the Oak, Walnut and Plane Trees on the other. It is only when we pass up to the *Apocarpœ in the Monocotyledons*, and to the *Micrembryeæ* and possibly *Piperaceæ* of the latter, there are many similarities of structure. To this reference must be made later, and it need only be said here that evidently the authors made no attempt to indicate by their arrangement of families any contact point between the Monocotyledons and Dicotyledons.

In the system of Engler and Prantl one might look for such a disposition of the families of the two sub-classes as to indicate a common point of origin, but in this we are disappointed. When we compare the structure of the families placed at the beginning of the Monocotyledons, viz: the *Typhaceæ*, *Pandanaceæ*, *Sparganiaceæ*, *Potamogetonaceæ*, *Naiadaceæ*, *Aponogetonaceæ*, *Alismaceæ*, etc., with those occupying a similar place in the Dicotyledons, viz: *Saururaceæ*, *Piperaceæ*, *Chloranthaceæ*, *Lacistemaceæ*, *Juglandaceæ*, *Myricaceæ*, *Leitneriaceæ*, *Salicaceæ*, etc., it is at once evident that here there is a great gulf between the two sub-classes. It is becoming more and more evident that this system, which promised so much, is little better as an expression of genetic relationship than the system of Bentham and Hooker, which it is now displacing. Its so-called lower families are for the most part composed of plants with not a simple, that is, a primitive structure, but a simplified structure. As a rational system, designed to express our ideas of genetic relationship, it is sadly disappointing.

It is evident that we must cease to confuse the simplified with the primitively simple structures, and that in the latter alone can we find the point of divergence of the plants of the two sub-classes under consideration. It is only when we do this that we are able to construct a system which shall suggest to us the solution of the problem. Our system must begin with simple pistils, not compound pistils—with really simple and simplified pistils. It matters little whether the flowers are perfect or not; whether they have many or few flowers-leaves, or even none at all. We have learned that these are minor matters, and that they change very readily even within narrow limits.

In accordance with these principles we may readily fix upon the apocarpous Monocotyledons (Bentham and Hooker's *Apocarpœ*) as the representatives of the primitive members of this sub-class. This struc-

* 'Evolution and Classification,' Proc. A. A. A. S., Vol. XLII., and 'The Significance of the Compound Ovary,' presented at this meeting.

ture will readily suggest the *Ranales* among the Thalamifloral Dicotyledons, and a closer examination shows a remarkable similarity of structure in not only the reproductive, but also in the vegetative organs of the plants of these two groups. After some years of study given to a comparison of these groups the author is more firmly convinced than ever of their genetic relationship. They show their relationship in their gross anatomy, the histology of their tissues and their embryology.

Allied to the *Ranales* are the *Rosales*, beginning with the Ranunculus-like *Potentilleæ*, and passing by easy steps to the simpler *Leguminosæ* on the one hand (*Cæsalpiniaceæ* and *Mimosaceæ*), and the *Saxifragaceæ* on the other, and through the latter to *Celastrales* and *Myrtales*.

Here then, in the author's opinion, is the point of divergence of the Monocotyledons and Dicotyledons, represented by the Apocarpæ of the former, and the *Ranales* and *Rosales* of the latter. The similarities in structure between some *Macrospermæ* and the *Naiadaceæ* in Bentham and Hooker's system, noticed above, as between some of the families (*Naiadaceæ*, *Alismaceæ*, *Chloranthaceæ*, etc.), placed by Engler and Prantl at the beginning of the two sub-classes, are hints as to a natural arrangement, which it is strange that these eminent systematists overlooked.

The development of the cystocarp of Griffithsia bornetiana: By Anna Arma Smith.

The development of the cystocarp of *Griffithsia bornetiana* was described, and it was shown to agree in the main with that in *G. corallina* as described by Janczewski, except only one peripheral cell bears a carpogenic branch. The spores arise from a cell cut off from the supporting cell of the carpogenic branch after fertilization, the influence of which is transmitted, apparently, through the cells of the carpogenic branch. Since the paper was published in the July number of the *Botanical Gazette*, and because of the author's absence, it was read by title.

Morphology of the canna flower: By L. H. Bailey.

The speaker called attention to the prevailing asymmetry in the Scitamineæ, and remarked that groups of plants which show marked irregularities in forms are nearly always fertile subjects for plant-breeding. The most nearly symmetrical flowers of this order are found in the banana tribe, in which 5 stamens are present and the 6th is represented by a sterile filament. He exhibited a banana fruit to show its 5-angled form, and remarked that it is probable that somewhere in its phylogeny this fruit had lost its symmetry. He also called attention to the three seedless loculi of the fruit, and remarked that, although the plant is seedless, it still varies or it is the subject of evolution, thus discrediting Weismann's hypothesis [that all progressive or permanent variation arises through sexual union.

In the ginger tribe the stamen is reduced to one normal member. In the canna tribe the stamen is presented by what is apparently but a single loculus of the anther, the other loculus being apparently developed into a foliaceous organ. The remaining stamens are represented by petal-like staminodia, and these members make up the showy part of the flower. The speaker exhibited specimens of canna flowers, and also charts, to show the very marked evolution in the form and size of the flower, and more especially of the staminodia, and the gradual increase in the size of the petal-like appendage of the one fertile stamen. There seems to be a considerable decrease in seed-production in the modern cannas as compared with the types of a generation and more ago, and this decrease is probably associated with less pollen, or less efficient pollen, in the modern flowers. This ten-

dency toward seedlessness is seen in many cultivated plants, of which the potato is a good example. Since new varieties come mostly from seeds, many persons have supposed that plant-breeding must eventually cease in these plants; but the speaker pointed out that the constant choice of seeds for sowing is itself a powerful agent in conserving the seed-producing power of the plant. So long as we select seeds, so long we may expect the effects of this selection to give seeds in at least a part of the individuals of every generation.

Distribution of plants on fresh-water islands: By CONWAY MACMILLAN.

The islands in Lake of the Woods were selected for study and description, and, after a general account of the geology and physiography of this body of water and its surroundings, a classification of islands was proposed as follows: 1. Floating bog islands; 2. Scirpus-bar islands; 3. Sand-dune islands; 4. Irregular rock islands; 5. Dome-shaped rock islands.

The paper proposed a classification of strand plants and surf plants, and laid particular stress upon an interesting zonal distribution of plants which characterized the dome-shaped islands. In these it was shown that an outer ring of shrub was succeeded towards the center by a zone of trees, an inner zone of shrub and a central meadow or shrub. This distribution was explained as resulting from the silting off of soil, until a thicker ring of soil was formed at the periphery of the islands.

The paper was illustrated by fifty lantern slides, showing island landscapes and calculated to bring out the points made concerning strand plants and zonal distribution, together with views of islands in which irregularity of surface prevented zonal and promoted crevice distribution.

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THE THIRD SUMMER MEETING OF THE AMERICAN MATHEMATICAL SOCIETY.

THE Third Summer Meeting of the American Mathematical Society was held in the lecture hall of the Buffalo Society of Natural Sciences, at Buffalo, N. Y., on August 31st and September 1st. Among those present were:

Dr. E. M. Blake, Prof. M. Bôcher, Mr. J. M. Brooks, Prof. F. N. Cole, Prof. J. E. Davies, Prof. A. T. DeLury, Prof. E. W. Davis, Dr. L. E. Dickson, Prof. W. P. Durfee, Prof. H. T. Eddy, Prof. T. S. Fiske, Miss Ida Griffiths, Dr. G. W. Hill, Dr. J. E. Hill, Dr. J. I. Hutchinson, Prof. E. W. Hyde, Prof. T. F. Holgote, Mr. P. A. Lambert, Dr. G. H. Ling, Prof. J. McMahon, Prof. M. Merriman, Prof. E. H. Moore, Prof. W. F. Osgood, Prof J. P. Pierpont, Dr. V. Snyder, Mr. W. M. Strong, Prof. O. Schmiedel, Prof. L. G. Weld, Prof. H. S. White, Prof. C. B. Williams, Miss E. C. Williams, Miss M. F. Winston, Prof. F. S. Woods and Prof. A. Ziwet.

The President, Dr. G. W. Hill, occupied the chair. Two sessions were held each day, beginning respectively at 10 a. m., and 2:30 p. m. The following papers were read:

1. *Methods of defining monogenic functions.* DR. E. M. BLAKE.
2. *An existence theorem for a class of linear euthymorphic functions of a single variable.* DR. E. M. BLAKE.
3. *A geometric method for the study of uniform convergence and certain double limits.* PROF. W. F. OSGOOD.
4. *Non-uniform convergence and the integration of series term by term.* PROF. W. F. OSGOOD.
5. *Two triply-infinite systems of simple groups.* DR. L. E. DICKSON.
6. *Ternray algebras.* PROF. J. B. SHAW.
7. *The geometry upon three surfaces of the seventh order.* DR. J. E. HILL.
8. *A special form of a quartic surface.* DR. J. I. HUTCHINSON.
9. *Note on the integral and integro-geometric series.* PROF. E. D. ROE.
10. *The cross ratio group of $n!$ $(n-3)$-ic Cremona transportations of flat space of $n-3$ dimensions.* PROF. E. H. MOORE.
11. *Criteria for the reality of nodes in Dupin's cyclides, with a corresponding classification.* DR. V. SNYDER.
12. *Numerically regular reticulations upon surfaces of deficiency higher than 1.* PROF. H. S. WHITE.
13. *Loci of the equations $p=\phi^x e$ and $p=\phi^x \psi^y e$* PROF. E. W. HYDE.